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WORK OF THE SIX-HORSE TEAM AND COST OF CROP-PRODUCTION IN CANTERBURY.

E. J. FAWCETT, B.A. (Cambridge), Assistant Instructor in Agriculture, Hastings.

IN the last December issue of the *Journal* the annual cost of keeping a six-horse team in Canterbury was fully discussed. It is the purpose of the present article to deal with the work done by such a team in the same province, and to make suggestions considered likely to reduce the cost of crop-production, mainly by a more even distribution of team work throughout the year.

In making this inquiry the investigator set out with the following definite questions in view: (1) Cost of upkeep of team; (2) area of all tillage operations performed in eight hours; (3) total area cultivated annually; (4) area under different crops; (5) period at which tillage operations are performed on different crops. Questions (1) and (2) were treated in the previous article, but before discussing the remainder a few remarks relative to (1) and (2) will not be out of place, as they have a direct bearing on any discussion pertaining to the six-horse team.

It was found that the "spread" or variation in twenty-seven estimates of cost of upkeep ranged from £762 to £446, giving an average cost of £548 5s. 8d. (Fig. 1). The largest number of estimates were below the average, suggesting that the actual cost is below £548 rather than above. Obviously there must be good reasons for this variation,

for, although records available were comparatively few and far between, the farmers from whom data were obtained are of a high standard, and reasonable reliance can be placed on their estimates. It appears, then, that the annual cost of the team, and the cost of crop-production generally, are influenced mainly by the following factors: (1) Soil

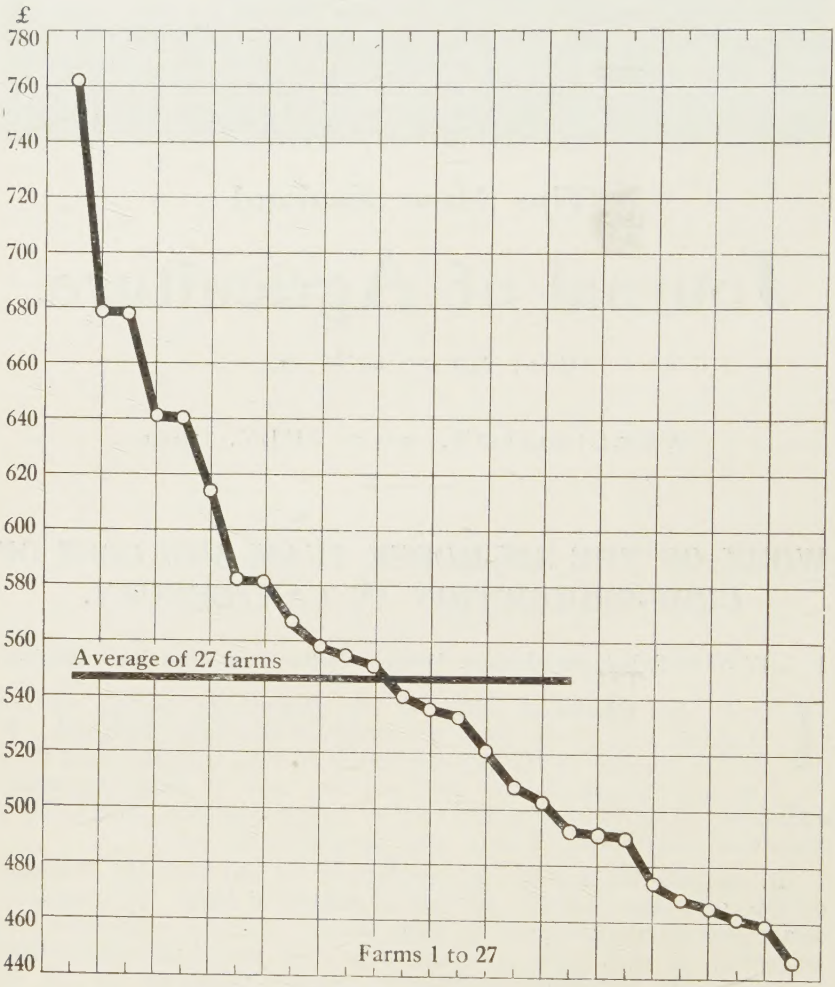

FIG. I. SHOWING SPREAD OF ESTIMATES OF COST OF UPKEEP OF SIX-HORSE TEAM IN CANTERBURY.

variation and farm location; (2) teamster's efficiency; (3) owner's capability in organization and control; (4) area cultivated.

The effects of soil variation and farm location are shown in a graph accompanying the previous article (see *Journal*, December, 1923, page 364), where it is clearly demonstrated that downs-land farming is subject to

greater variation than any other, the annual cost being greater on this type of farm than elsewhere. The cost on light land most nearly follows the average for the whole group.

The teamster is perhaps the greatest factor in the control of expenditure, although it is difficult to separate him entirely from the owner in this respect, as it is the business of the farmer to exercise a careful supervision of the ploughman. On behalf of the teamster it is only fair to say that he is often working under very adverse conditions, living as he does almost continuously with his team from morning till dark, when he returns to quarters often leaving much to be desired. For a worker to give of his best he must be contented, and no man is contented unless he is comfortable. In the investigation it was found that wherever a married ploughman was employed the farmer was satisfied with the work done. The married man is expensive in initial outlay, as he must have a cottage and be allowed a garden, and probably grazing for a cow; but the present indications in Canterbury point to a more general employment of married men on farms. The ploughman can save money on the cost of the team in many ways. For instance, the estimated consumption of chaff on the twenty-seven farms varied from 22 to 40 tons, with an average of 31 tons. The feeding-capacity of six horses cannot vary to such an extent, and undoubtedly wastage is often taking place. A careful ploughman can rectify this in many cases. It is just as important to study the feeding of a horse as it is that of a dairy cow. A man also who spends spare time overhauling implements and harness can save greatly on repairs and breakages, for it is always the neglected implement that has the heavy cost of upkeep.

The owner should exercise a keen general supervision over his ploughman, but his thoughts should mainly be centred on the organization of his cropping-system. The whole trend of his farm practice should be towards the more even distribution of team work over the whole year. The maintenance of team efficiency is another point which should receive the careful consideration of every owner. In making this investigation three methods came under notice: (1) Breeding young horses on the farm, drafting them into the team at about four years of age, and working them their full period of usefulness; (2) buying young broken horses, and working them in the same way; (3) buying young broken horses, working them to full capacity during appreciating years, and before they begin to depreciate selling them at a profit. No definite age can be laid down for quitting a horse under the last-mentioned system, but it is the one likely to reduce replacement and depreciation cost to a minimum, cutting out as it does all losses excepting accidents and deaths. In the estimates given, £30 is the average annual cost of team replacement, £10 of which covers accidents and deaths, and £20 depreciation over the period.

The area cultivated does not appear to influence the total cost considerably, although it has a very serious bearing on the cost of producing individual crops. The cost of tillage operations decreases as the acreage cultivated increases.

The average cost of tillage operations is shown in the table which follows. Table 8 of the previous article may also be referred to

Table 1.—Cost of Tillage Operations—250 Days' Work.

(Average annual cost, £548 5s. 8d.)

Operation.	Acres per Day (Average).	Cost per Acre.
		s. d.
Deep ploughing	4·64	9 5
Skim-ploughing	5·13	8 6
Disking	14·00	3 2
Grubbing	13·20	3 4
Heavy harrowing	28·40	1 7
Light harrowing	30·50	1 5
Drilling	14·00	3 2
Rolling	17·77	2 6

In connection with the accompanying graphs the following standards for tillage operations are used :—

Wheat : Skim-plough, deep plough, double disk, grub (twice), heavy harrow, drill, harrow, harrow and roll, cut and cart.

Oats : Skim-plough, deep plough, grub (twice), heavy harrow, drill, harrow, cut and cart.

Green feed : Skim-plough, deep plough, double disk, grub (twice), heavy harrow, drill and harrow.

Rape and turnips : Skim-plough, deep plough, grub (twice), harrow, drill and harrow.

Working on these standards a team of six horses should be able to cultivate, sow, and harvest at the following approximate rate per day, provided that the area of any crop be not less than 20 acres in one field : Wheat, 1 acre ; oats, 1·23 acres ; green feed, 1·2 acres ; rape, 1·4 acres ; turnips, 1·4 acres ; peas, 1·1 acre ; linseed, 1·1 acre. The cost of team work per acre can be calculated for any cropping-system where the daily cost of the team is known, by dividing the daily cost by the daily area for the respective crops as given above.

The total area under cultivation varied very widely as between the different farms, ranging from 131 acres on farm No. 23 to 375 acres on farm No. 12, the average area over the twenty-seven farms being 232 acres. At a casual glance these figures suggest that many farmers are not justified under their present cropping-system in keeping a six-horse team. Taking two farms, one having a high annual cost of team-upkeep and comparatively large area under cultivation, the other a low annual cost and small area under cultivation, it is interesting to note the cost of team work on the crops in each instance.

In ascertaining the cost of team work on crops as shown in the accompanying graphs and tables, the standard tillage operations quoted above have been used in conjunction with the average area worked by a six-horse team in all tillage operations. Having obtained the minimum number of days required to work the given cropping-system, 20 per cent. has been added to allow for extra work performed by the team, and for lost time through breakages and unavoidable stops, such as moving from one field to another and changing of implements.

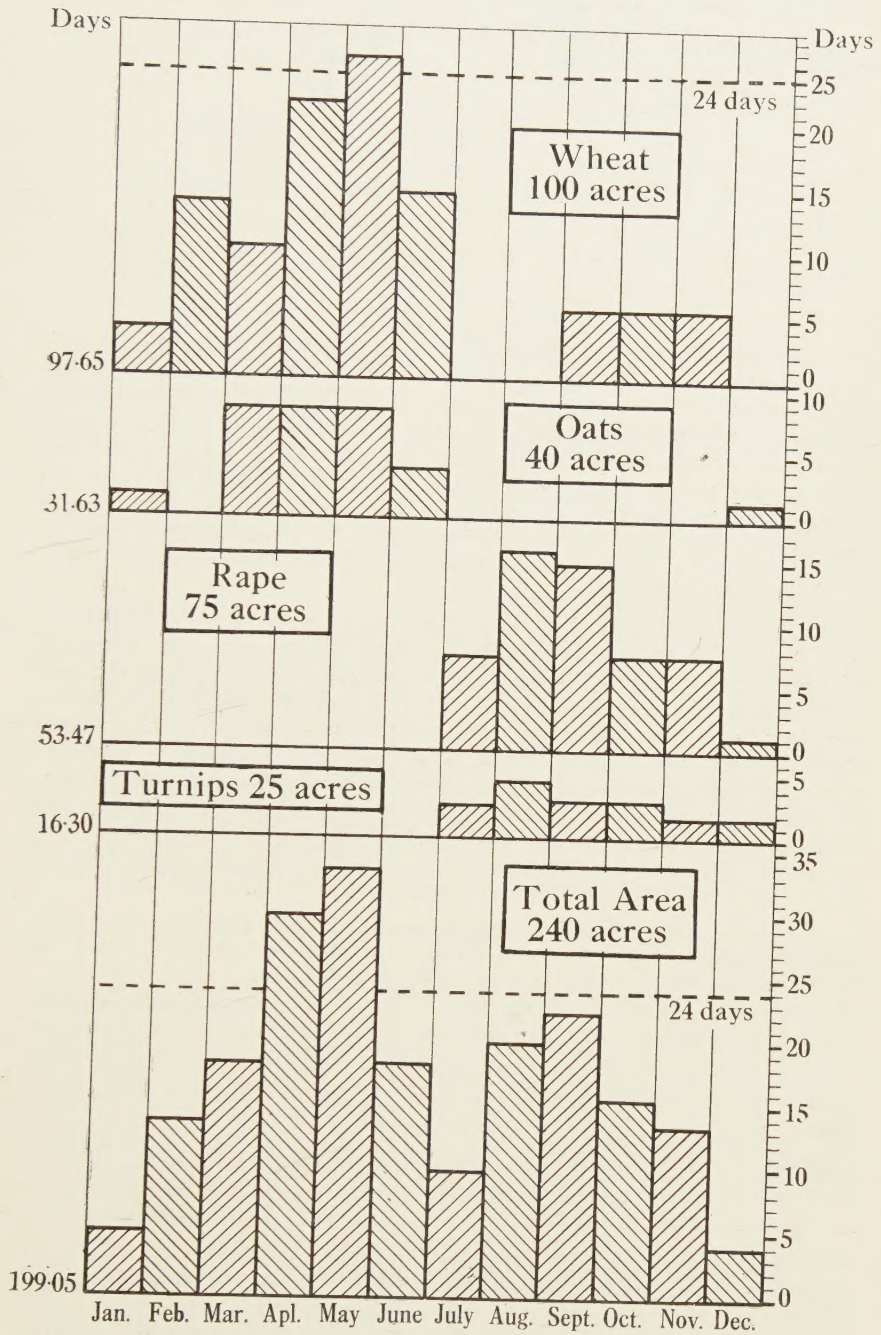

FIG. 2. DISTRIBUTION OF WORK ON FARM NO. 2.

Table 2: Farm No. 2.

Annual estimated cost of team, £679 5s. 8d. Area cultivated, 240 acres. Minimum number of days worked, 199 + 20 per cent. = 238 days. Daily cost of team, £2 17s.

Crop.	Area.	Cost of Team Work per Acre.
	Acres.	£ s. d.
Wheat	100	2 17 0
Oats	40	2 4 10
Rape	75	2 0 8
Turnips	25	2 0 8

While making this investigation information was collected as to the approximate dates of tillage operations for the respective crops. Using this information, any system of cropping can be studied diagrammatically, illustrating the number of days worked per month on any crop, and collectively on the whole system over the year. In doing this it has been assumed that twenty-four days is the maximum that can be worked per month, and where any tillage operation is likely to be carried out over two or more months the days required to perform that operation for the given area have been equally divided in the graphs over the months concerned.

It will be seen from Fig. 2 that the cropping-system on this farm (No. 2) is a difficult one. Each column in the graph represents the work for one month, reading January to December, from left to right; and each division in the scale represents one day's work. It will therefore be seen that it is impossible to carry out this programme on the tillage standard set in the present article, as during April and May this area of wheat and oats requires more work than six horses can accomplish. By reducing the area under wheat and oats such modified programme could be carried out at an increased cost per acre.

Table 3: Farm No. 23.

Estimated annual cost of team, £467 12s. 5d. Area cultivated, 131 acres. Minimum number of days required, 111 + 20 per cent. = 134 days. Daily cost of team, £3 9s. 9d.

Crop.	Area.	Cost of Team Work per Acre.
	Acres.	£ s. d.
Wheat	50	3 9 9
Oats	20	2 14 10
Green feed	23	2 18 0
Rape	13	2 9 8
Turnips	25	2 9 8

It will be noticed that although the total annual cost on this farm is low, the cost of tillage operations is very high, and it is really costing more to produce crops than on the farm with the high cost of team-upkeep. If the work, as shown in Fig. 3, is studied the reason is obvious. On a farm of this nature two horses should be sold, or the area under cultivation materially increased.

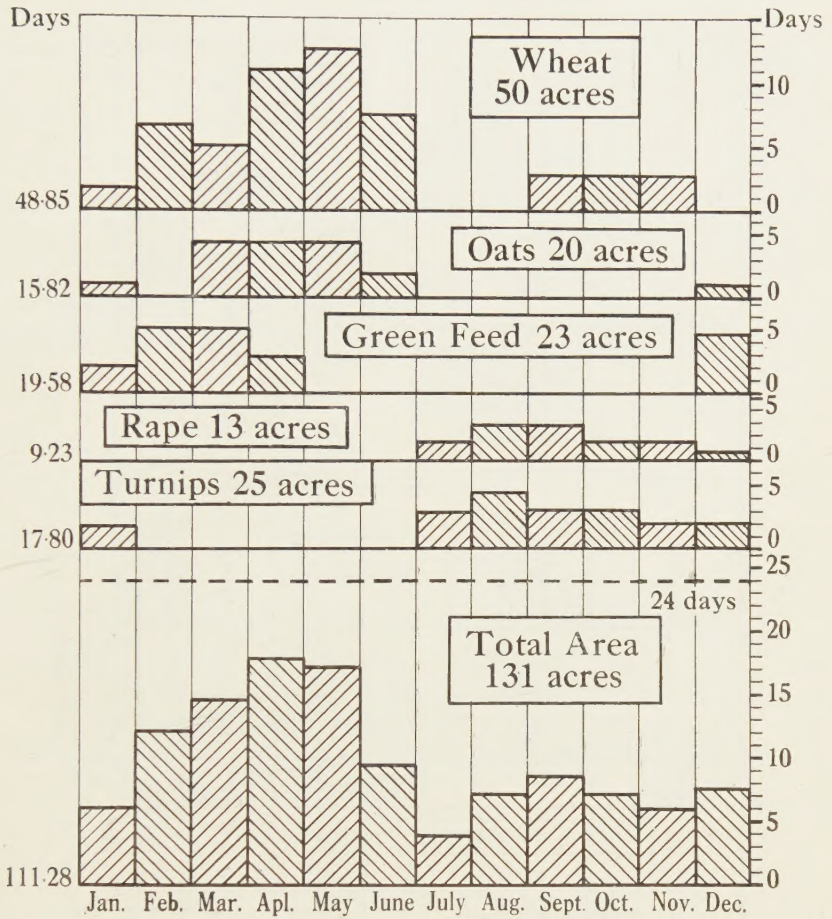

FIG. 3. DISTRIBUTION OF WORK ON FARM NO. 23.

A study of farms working the typical Canterbury programme—namely, wheat, oats, green feed, rape, and turnips—has disclosed a weakness in the system, which, although known by many farmers to exist, has never previously been properly demonstrated. The average areas given by farmers as under cultivation in different crops are as follows: Wheat, 82 acres; oats, 43 acres; green feed, 56 acres; rape, 41 acres; turnips, 32 acres. It is apparent that the whole of the wheat, oats, and green feed cannot be handled in the autumn; therefore wheat and oats have been broken up into autumn and spring sowings, as shown in Fig 4.

It is apparent that the heavy periods under this distribution are February, March, and August. At the foot of this graph the relationship of ploughing to other operations is shown for such a cropping-system. If the whole of the wheat be sown in the autumn, congestion takes place during March, April, and May, with comparative idleness in the spring.

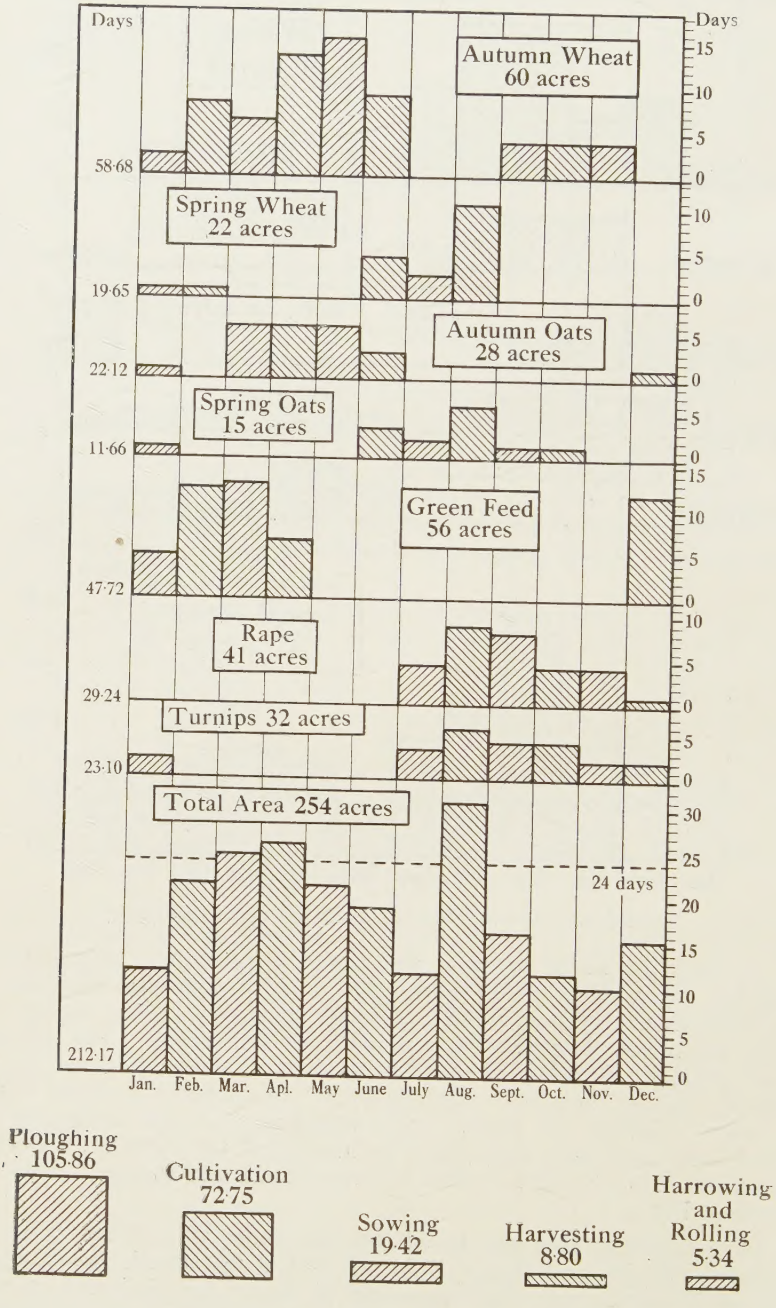

FIG. 4. TYPICAL CROPPING-SYSTEM IN CANTERBURY.

The relationship of ploughing to the other operations is shown at foot, the figures signifying days.

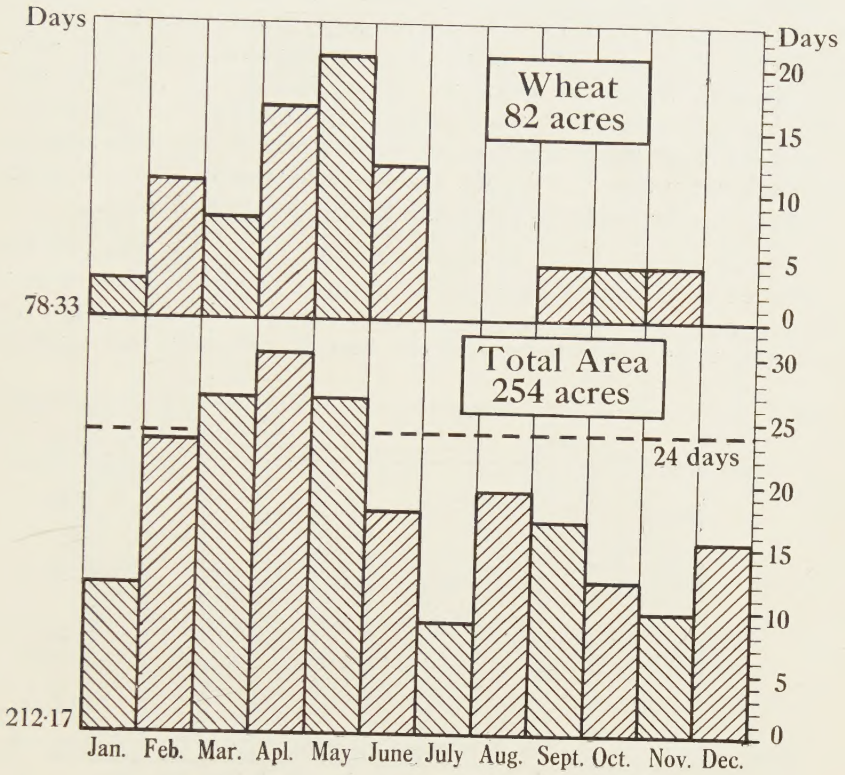

FIG. 5. CROPPING-SYSTEM IN WHICH ALL WHEAT IS AUTUMN-SOWN.

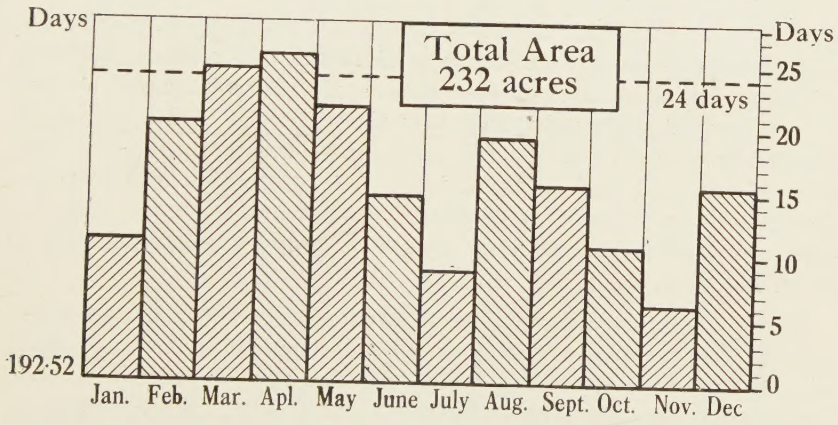

FIG. 6. CANTERBURY CROPPING-SYSTEM SIMILAR TO THAT SHOWN IN FIG. 4, BUT WITH SPRING WHEAT ELIMINATED.

Fig. 5 shows this position, so prevalent in Canterbury. To cope with the autumn work extra horses are kept, and at once the cost of production is raised. It is in this type of cropping particularly that consideration should be given to the advisability of reducing the cropping-programme rather than increasing the team. If the programme is reduced by dropping the 22 acres of spring wheat, otherwise keeping the distribution suggested in Fig. 4, a six-horse team can work it fairly comfortably, the heavy months being March and April (Fig. 6).

A slack period should be felt during the spring, but this can be controlled by growing 20 acres of one or more of the following crops: Linseed, peas, potatoes, swedes, spring vetches—or by fallowing. In arranging this it must be remembered that linseed, peas, and vetches

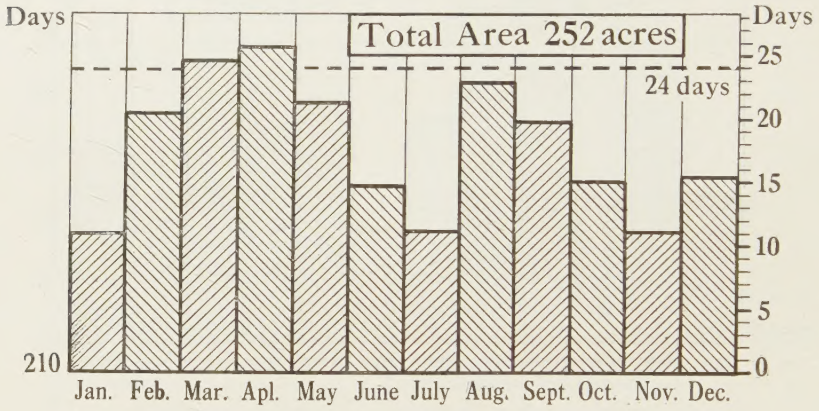

FIG. 7. CANTERBURY SYSTEM WITH SPRING WHEAT ELIMINATED, BUT AUGMENTED WITH 20 ACRES OF OTHER SUITABLE SPRING CROPS.

have to be harvested at the busy season. A safe method, therefore, is perhaps an increase in area of rape and turnips, or growing swedes or potatoes. The other alternative—fallow—is the one which should perhaps be more generally adopted than it is at the present day. If a reasonable area is fallowed each year it can be used for the wheat or green-feed crop, thus reducing the work in the autumn. A programme such as this—252 acres under cultivation—could be worked in the minimum of 210 days, or by adding 20 per cent. 252 days, giving a daily team-cost of £2 3s. 10d. (Fig. 7).

There is another definite type of farming practised in Canterbury—namely, that in which wheat is eliminated completely, the main object being the production of sheep-feed. On this type of farm it is found that the average areas under crops are as follows: Oats, 58 acres; green feed, 85 acres; rape, 53 acres; turnips, 35 acres; and fallow unspecified (Fig. 8).

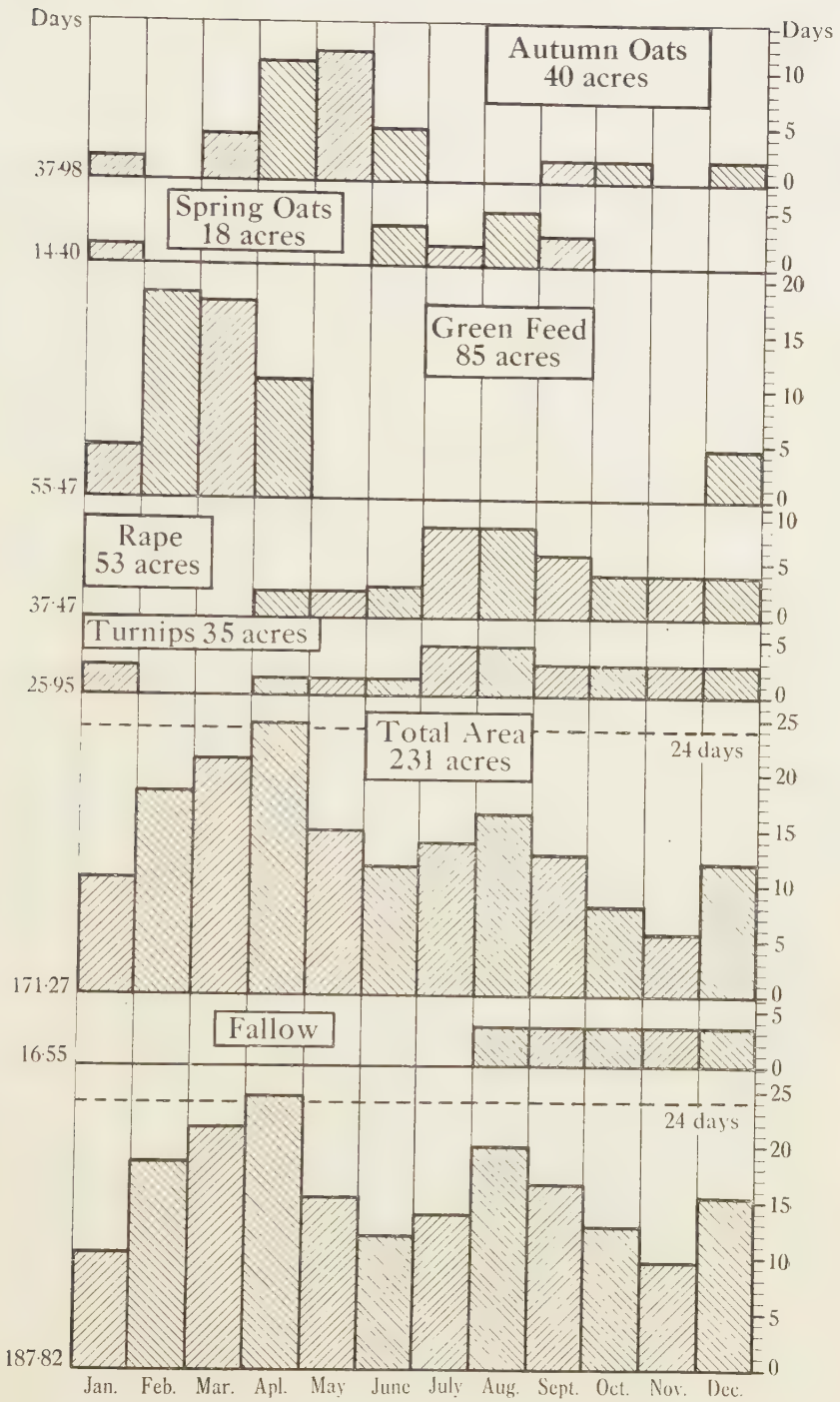

FIG. 8. CANTERBURY SYSTEM WHERE SHEEP-FEED IS THE MAIN OBJECT. NO WHEAT GROWN.

The bottom section includes the unspecified area of fallow.

It will be seen that this scheme gives a moderately large area under the plough, but team work is light. Even if a large area were fallowed, the spring should be a slack period; and, again, peas, linseed, spring vetches, or swedes could be grown to advantage (Fig. 9). If this were done the area under the plough could be increased to 251 acres, giving a minimum of 205 working-days, or with 20 per cent. added 241 days, giving a daily cost of £2 4s. 7d.

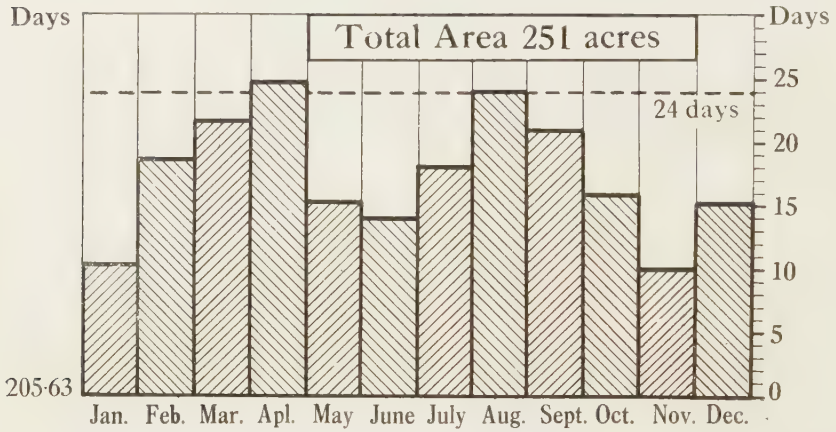

FIG. 9. CANTERBURY SYSTEM AS IN FIG. 8, BUT AUGMENTED WITH 20 ACRES OF SPRING CROPS (PEAS, LINSEED, OR SWEDES).

It appears that under Canterbury conditions the smallest area on which a six-horse team should be kept is 360 acres worked on a six years' rotation. To do this 180 acres would be under the plough, 60 acres to be cropped twice in the year. This would leave 180 acres of grass ranging from one to three years old. The rotation suggested is as follows: Wheat, 60 acres; green feed, 60 acres; turnips, 30 acres; linseed, 30 acres; oats, 30 acres; rape, 30 acres; grass—60 acres three-years-old, 60 acres two-years-old, and 60 acres one-year-old pasture. The work for the team (Fig. 10) shows a slack period in the spring, which can be filled by fallowing if desired; but, as it stands, 240 acres of crop would be handled each year in a minimum of 202 days, or with 20 per cent. added 242 days, giving a daily team-cost of £2 5s. 4d.

Every extra horse kept on the farm costs approximately £44 per annum. If on the farm of 360 acres it is necessary to keep extra horses to handle twitch or any abnormal condition, then the rent of the farm should be reduced £44 per annum for every horse so kept. In other words, if an extra horse has to be kept on a farm of this size the capital value of the land should be depreciated by approximately £2 per acre.

Summarizing the foregoing considerations it appears that greater care should be exercised in the management of farm teams in Canterbury. The object of every owner should be the development of a farming-system calculated to employ the team for the greatest number of days possible, such work to be distributed evenly throughout the year.

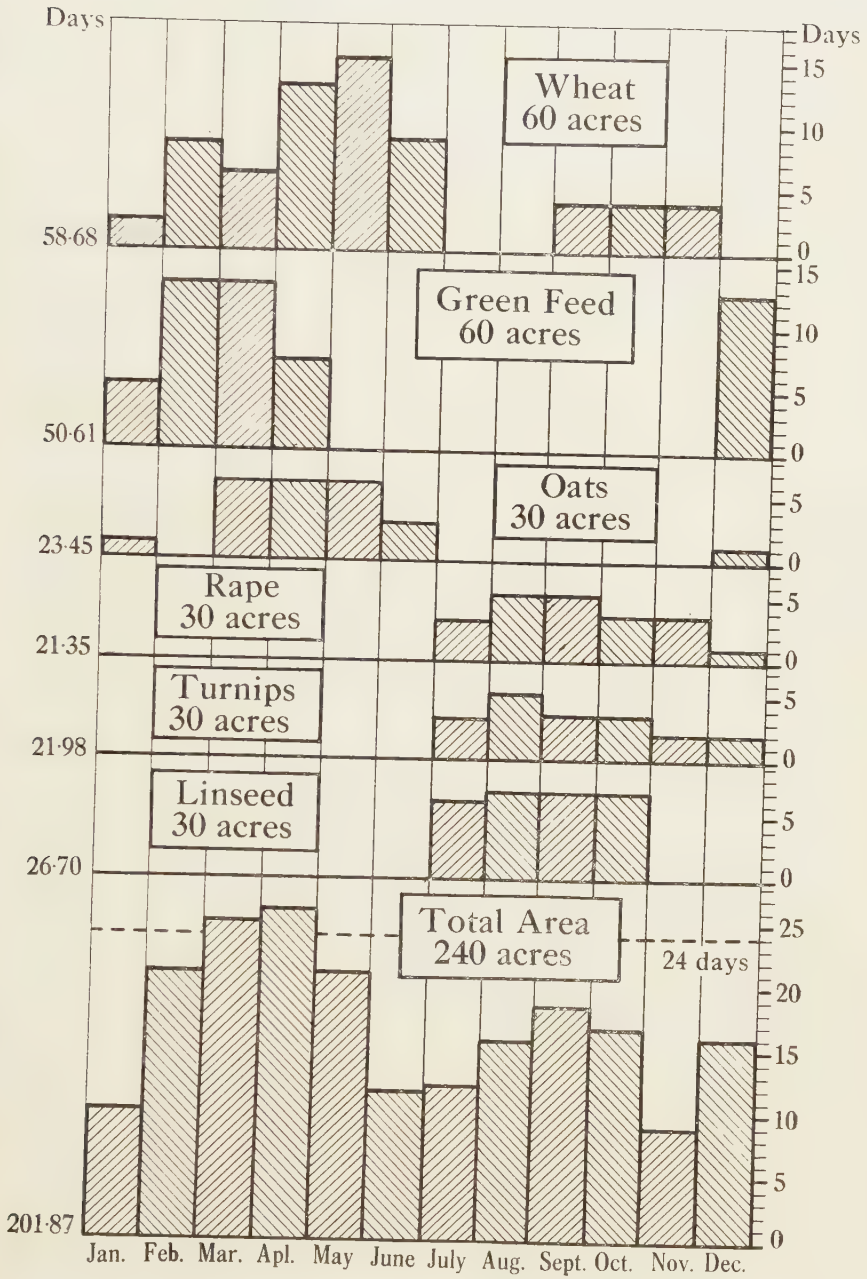

FIG. 10. A CROPPING-PLAN SUGGESTED FOR CANTERBURY.

THE BUSH-SICKNESS INVESTIGATION.

LABORATORY WORK AND RESULTS.

(Continued.)

B. C. Aston, F.I.C., F.N.Z.Inst., Chemist to the Department.

COMPOSITION OF PASTURE PLANTS.

In examining the composition of the natural food of the ruminants pastured on bush-sick country the inorganic or mineral constituents of the ash have been examined. Some of the results are of considerable interest, and are given in the following pages. The investigation of fodder plants is being continued, especially as regards the grasses and hays of the pumice land.

W. Pfeffer ("Physiology of Plants," 1900, p. 428) states that ordinary plants are fully supplied with iron when 0·2 per cent. is present in the ash, so that an adult maize-plant of 200 grams dry weight, yielding 8·9 grams of ash, would contain 0·016 gram of iron (Fe), and the crop from a hectare (2½ acres) would equal 200 kilograms of ash, and would remove from the soil 0·4 kilogram of iron. Hall ("Fertilisers and Manures," 1910, p. 270) states that "the plant requires very little iron indeed; as a rule not more than 1 per cent. of the ash of a plant consists of oxide of iron; 2 per cent. might be taken as an outside limit, so that the amount of oxide of iron taken from the soil by a heavy crop of mangolds, the leaf of which is especially rich in iron, only amounts to about 10 lb. per acre." We have thus two estimates for two very different crops—0·4 kilogram of iron (Fe) per hectare for maize (5·6 oz. per acre), and 10 lb. of iron oxide (Fe_2O_5) (= 7 lb. iron per acre) for mangolds.

Regarding the content of iron in the plant, one meets with difficulties in obtaining good samples of fresh organized material throughout this investigation owing to the great distance of the Department's Chemical Laboratory from the affected country, and the difficulty becomes accentuated when putrescible substances such as animal specimens are dealt with. With regard to fodder-plant research, the contamination of the plants collected from the field by particles of pumice constitutes another formidable difficulty, as the pumice yields to hydrochloric acid more iron than does the plant-ash. Pumice yields about 1 per cent. of iron, and plant-ash about one-fifth of this. Hence the results of plant-ash analysis may be considerably raised by the inclusion of this impurity. The same difficulty has occurred in an investigation in another country. Some results are therefore here given of analysis of clovers grown in pots under glass in order to try to learn something of the iron content of pasture plants. In this series only red clover is dealt with, which is probably the principal fodder plant of the pumice lands. The results show that the iron generally increases in the plant as it matures, whatever the manuring. Hydrated iron oxide appears to be a suitable iron compound to experiment with in the field as a soil-dressing. It has many obvious advantages over spent oxide and ferrous sulphate (sulphate of iron).

The percentage of iron in the first cuts is low (but not so low as is found in plants gathered in the field), a fact which may explain why stock are particularly liable to develop bush sickness in the early

months of summer. There is evidence that the amount of iron in young growth may sink to a quarter (0·05 per cent.) of the amount quoted by Pfeffer (0·2 per cent.). R. Warrington, in Watts's Dictionary of Chemistry (Vol. vii, p. 526, 1883), gives a series of analyses of red-clover samples taken through the spring and summer months (Northern Hemisphere climate) in which the iron is specially given as follows :—

Table 3. Iron in Red Clover.

Soil, &c.	Percentage of Iron (Fe) in Ash.	Parts of Plant.
First crop—garden soil :—		
Period I, April 30 ..	0·58	Leaf and stalk.
Period II, May 23.. ..	0·48	Stem, leaf, and stalk.
Period III, June 21 ..	0·65	Stem, leaf, stalk, and bloom.
First crop—field soil :—		
Period I, May 20.. ..	0·81	Stem, leaf, and stalk.
Period II, June 23 ..	1·11	Stem, leaf, stalk, and bloom.
Period III, end of August ..	1·73	Stem, leaf, stalk, bloom, and seed.

The results may be compared with the low figures given by red clovers grown on bush-sick land (Table 4). The percentage of phosphoric acid present in the red clover is given by the same authority, from which it appears that this constituent is also much higher than is experienced with pumice-grown clovers, and ranges from 11 to 14 per cent. on the ash.

Table 4. Clovers from Bush-sick Country.

Sample No.	Month collected.	Locality.	Fodder.	Manuring.	Percentage of Iron on Ash.	Remarks.
C 1316/1	Nov.	Mamaku ..	Clovers and trefoil	Basic slag and super (4 cwt.)	0·247	
C 1316/19	Dec.	Lichfield ..	Red clover ..	Basic slag ..	0·152	
C 1316/29	,,	,, ..	Lucerne ..	..	0·113	
D 33/11	Jan.	Mamaku ..	White clover	Unmanured	0·137	Best land in hollows.
D 33/18	,,	Ngawaro	Red clover ..	,,	0·069	
D 33/19	,,	Mamaku ..	White clover	Slag and super. (4 cwt.)	0·207	
D 33/23	,,	,, ..	,,	Blood-and-bone	0·156	Lichfield Road.
D 33/26	,,	Lichfield ..	Red clover ..	Iron and super	0·126	
D 347/1	Mar.	Mamaku ..	White clover	Unmanured	0·220	Short clover.
D 347/2	,,	,, ..	,,	Basic slag ..	0·320	
D 347/3	,,	,, ..	,,	Super and basic slag	0·760	Best manure for Mamaku land.
D 347/4	,,	,, ..	,,	Super ..	0·270	
D 347/21	,,	,, ..	,,	Super, bone, and guano (6 cwt.)	0·194	
D 347/20A	,,	Te Pu ..	Red clover ..	..	0·141	
D 347/31	,,	Mamaku ..	White clover	Iron sulphate	0·230	
D 347/32	,,	,, ..	,,	Super and lime	0·236	
D 347/33	,,	,, ..	,,	Lime ..	0·217	
D 347/34	,,	,, ..	,,	Potash ..	0·083	
D 347/35	,,	,, ..	,,	Unmanured	0·150	
D 347/40	,,	Lichfield ..	,,	Control ..	0·230	

Table 5. Clovers from Normal or Healthy Pumice-country.

Sample No.	Month collected.	Locality.	Fodder.	Manuring.	Percentage of Iron on Ash.	Remarks.
C 1316/20	Dec.	Te Ngae ..	Yellow trefoil	Unmanured	0·323	
D 33/14	Jan.	Ngongotaha	White clover	,,	0·405	Swamp land.
..	,,	Wellington	Yellow trefoil	,,	0·640	
D 106/2	,,	Moumahaki	Red clover ..	*	1·940	
D 107/2	,,	Lincoln ..	,, ..	*	0·232	
D 104/2	,,	Collingwood	,, ..	*	0·400	
D 347/14	Mar.	Ngongotaha	White clover	Unmanured	0·672	
D 347/13	,,	Onuku ..	,,	*	0·430	
D 347/15	,,	Ngongotaha	,,	..	0·495	
D 347/20	,,	Rotorua ..	,,	Unmanured	0·460	Growing on red pumice.
D 347/23	,,	,, ..	Yellow trefoil	,,	0·473	Ditto.
D 347/28	,,	Reporoa ..	White clover	..	0·529	Closely cropped.
D 347/45	,,	Ruakura ..	,,	*	1·240	,,

* Manuring (if any) unknown.

Table 6. Percentage of Iron (Fe) in Red-clover Ash from Plants grown in Pots in Pumice Soil.

Pot No.	First Cut.	Second Cut.	Third Cut.	Fourth Cut.	Fifth Cut.	Sixth Cut.
1 ..	..	..	0·18	0·38	0·40	0·35
2 ..	..	..	0·18	0·32	0·31	0·33
3 ..	..	..	0·19	0·33	0·28	0·33
4* ..	0·18	..	0·24	0·35	0·30	0·45
5 ..	..	..	0·20	0·40	0·35	0·45
6 ..	0·16	..	0·18	0·32	0·30	0·45
7* ..	0·18	..	0·24	0·29	..	..
8† ..	0·19	0·12	0·17	0·45	0·39	0·47
9† ..	0·21	0·13	0·27	0·42		
10 ..	0·14	0·11	0·14	0·43	0·35	0·40
11 ..	..	0·09	0·18	0·35	0·32	0·41
12 ..	0·13	0·11	0·16	0·40	0·39	0·43
13 ..	0·16	0·11	..	0·47	0·30	0·33
Date of cutting	Dec. 2	Dec. 22	Jan. 16	Mar. 17	June 22	Sept. 2

* Pots 4 and 7 analysed together in last two cuts. † Analysed together in last two cuts.

The manuring for each pot was—

1. 246 grams carbonate of lime.
2. 82 grams carbonate of lime.
3. 16·4 grams carbonate of lime.
4. Control—no manure.
5. 8·2 grams spent oxide from gasworks.
6. 4·1 grams superphosphate (19·5 per cent. P_2O_5).
7. Control—no manure.
8. 1·23 grams pure ferrous sulphate.
9. 8·20 grams hydrated iron oxide.
10. 4·10 grams basic slag (17·8 per cent. P_2O_5).
11. 4·10 grams Pacific Island phosphate (37·4 per cent. P_2O_5).
12. 4·10 grams basic slag and superphosphate (equal parts).
13. 164·0 grams stable manure, rotted.

The fourth cut must be considered the main crop of this series. It occupied the longest time in active growth, and contained the greatest amount of dry matter.

Table 7. Percentage of Phosphoric Acid (P_2O_5) in same Pots as in Table 6.

Pot No.	First Cut.	Second Cut.	Third Cut.	Fourth Cut.	Fifth Cut.	Sixth Cut.
1 ..	..	2·69	4·1	3·28	4·25	5·2
2 ..	..	2·94	4·1	3·01	2·73	4·4
3 ..	..	3·14	3·2	1·97	3·70	5·7
4 ..	2·47	3·84*	3·9	2·00	2·98*	4·4*
5 ..	4·07	..	5·1	3·16	3·12	3·7
6 ..	4·51	5·28	5·7	4·45	5·60	..
7 ..	2·94	3·84*	3·1	2·05	2·98*	4·4*
8 ..	2·80	3·99	3·8	3·61	2·90	5·0
9 ..	2·96	4·28	3·5	3·31		
10 ..	4·32	5·46	5·2	7·05	5·17	..
11 ..	4·41	5·53	5·5	6·59	5·96	..
12 ..	4·36	5·65	5·7	6·79	5·65	..
13 ..	3·72	5·16	5·1	5·48	4·90	..

* Control pots' contents analysed together. In the case of the first and second cuts of the limed pots and of the fifth and sixth cuts of the iron-manured pots the contents were analysed together on account of the paucity of the samples.

It will be seen that the mineral phosphates have had the effect of more than trebling the absorption of phosphoric acid by the plant, the slagged crop being particularly rich in this valuable constituent. The effect of the dung is also most marked in the same direction. It will be noticed that large dressings of lime had a retarding effect on the growth of the first and second pots, while the small amount in Pot 3 had so little effect that it may be treated as an additional control pot. The use of culture-pot experiments in the elucidation of manurial problems is often very valuable, but deductions from them must not be considered final until confirmed in the field. The conditions of water-supply in pot experiments are entirely artificial when the tests are carried out under glass, and yet this is the only way in which plants can be secured free from contamination of soil-particles. Compaction of the soil is also an improvement of pumice soils which is effected by potting and watering, and such improvement would not be imitated in the field with similar experiments. For instance, carbonate of lime on pumice soils in pot experiments completes its retarding effect on pasture in a few months, but in the field there is evidence that this effect lasts very much longer. (For turnips in the field the effects of lime are, of course, very much quicker and highly beneficial, even on coarse pumice soils.)

Considering the evidence yielded by analyses of fodder plants from the affected pumice-country, from healthy pumice-country, and from normal country elsewhere, and considering the opinions which are the result of European experience, there is, the writer believes, good evidence to show that the clover-plants from bush-sick land in their most vigorous growing-period have a much lower iron content than normal.

(To be continued.)

Noxious Weeds.—The Wellington City Council has declared hemlock to be a noxious weed within the area under its jurisdiction.

PLANT-SELECTION AND SEED-PRODUCTION.

WORK AT THE MOA SEED FARM.

J. W. HADFIELD, Manager, Moa Seed Farm, Dumbarton, Central Otago.

I. PLANT-SELECTION.

On every progressive seed-farm a considerable amount of time is necessarily devoted to the production of "stock," "elite," or "stud" seed. This stock seed, which may become the most valuable property of the seed-grower, is not sold, but is used exclusively by him for sowing the crops from which he produces commercial seed. The stock seed thus forms the very foundation upon which reputable seed-production is built, while upon the care and initiative of the breeder depends the quality of the stock seed. The object of these notes is to outline what we are doing on the Moa Seed Farm in plant-selection and the production of stock seed. In a subsequent article the writer proposes to deal briefly with our methods of producing commercial seed.

Soil and climatic conditions play a large part in the appearance and viability of seed; but the appearance of seed which is not itself used for consumption, such as carrot, parsnip, and mangold, except in so far as it indicates satisfactory and careful harvesting, is by no means of such importance as is generally supposed. Viability, though certainly of great importance, cannot become the one determining factor, because it sometimes happens that the highest-quality stock seed is somewhat lacking in this respect. As seed-growers we consider the only true indication of quality is determined by comparative field trials, where it is possible to determine the most important quality or defect in the seed—namely, its varietal purity or trueness to type. This fact is becoming more generally recognized by the grower, mainly as a result of the activities of the crop inspection and certification services of such countries as Canada, the United States, and Denmark. There is also at the present day a definite movement, backed by the seedsmen themselves, to eliminate the large number of synonymous varieties and bring our nomenclature to a simple straightforward basis. The National Institute of Agricultural Botany, at Cambridge, has done a considerable amount of work in this connection, and the United States Department of Agriculture is working on the same lines.

BIENNIAL ROOT CROPS: METHODS OF SELECTION.

The method here described is, in principle, that adopted in the selection of mangolds, beets, carrots, parsnips, and onions. Any crops which have not been grown commercially at the Moa Seed Farm are not here discussed.

Mangolds, beets, and carrots, of which we grow several varieties, are very liable to cross-pollinate, and it is necessary to ensure against this by planting a sufficient distance apart. This is of particular importance in varieties of distinct type and colour, for, while we might take a little risk of cross-pollination between, say, Ox-heart carrot and

Early Horn, we must guard against any possibility of cross-pollination between either of these varieties with a long scarlet or a white variety.

Commencing with a crop grown from the best commercial seed procurable, we make sufficient selections for our purposes when the roots are being dug. Taking one hundred as a convenient number, these are laid out on the ground and fifty are selected, these being those which conform most closely to our ideal. The remaining fifty are reserved as second-quality selections, to which reference will be made later. The fifty first selections are numbered, notes taken if desired, and are stored away over winter in a frost-proof root-store. In the spring, when the main crop is being planted, these selections also receive attention, and are planted, whenever possible, in an isolation plot sufficiently far removed to avoid any danger of cross-pollination with other plants of even the same variety. This is certainly the most desirable method, but, unfortunately, not always practicable on a farm where one's resources are taxed to keep even the main seed crops sufficiently far apart. Under these circumstances we plant the first-quality selected roots in the centre of the main crop, and surround them on all sides with the second-quality selections to which reference has already been made. This we find the best practical method.

When seed is formed the selections are examined, and quite a number are generally discarded on account of poor seeding-properties. This culling is very necessary, since we find a decided tendency for high-quality roots to produce very little seed, and, as we are primarily seed producers, we have to strike a balance between root quality and seed-production. A great deal of variation is to be observed in the seed and seed-bearing parts of carrot, parsnip, and mangold. Most of it is of no commercial significance, but some is. In parsnip, for example, the colour merges into a purple, while other plants produce almost seedless umbels; but the most objectionable property is the tendency of certain roots to produce puffed triangular clusters, the seeds of which contain no kernel.

When the remaining plants ripen seed a little from each of the first-quality selections is reserved, each in a marked packet, for sowing in the trial plots the following season. The remainder of the first-selection seed is bulked, and forms seed for sowing the main crop in the following season. The seed from the second-quality roots is also harvested, and forms a reserve in case of failure, or in case the seed from the first selections is not sufficient to meet requirements.

The seed-samples reserved for the trial plots are carefully examined, and sometimes germination tests are made. The following spring they are sown on well-prepared ground in rows about 1 chain long, each sample in a separate row. Thus each row is the direct progeny of one of the originally selected roots. The area reserved for the trial plots should be in the best possible condition. This is important, since unsatisfactory conditions will induce so much malformation as to completely swamp any slight differences which might otherwise be observed between one row and another. Thinning and cultivation must be done most carefully and uniformly, and an endeavour made to allow each row full and equal development.

When these rows are dug we endeavour to decide on the best and second best. This is by far the most difficult part of the work, and

may entail hours of careful consideration before a final selection is made. We adopt different methods to arrive at a conclusion. Quite a number of rows can generally be discarded for possessing some undesirable character. For the remainder we find the most satisfactory method is for one man to sort each row into selections and culls, and, from the numbers of each, calculate a figure representing the proportion of selections as against culls. This generally reduces the number down to four or five, and from each of these the fifty best roots are taken and laid out in parallel rows, and a final selection made.

Having now the fifty first selections and the fifty second selections of roots we recommence by planting these in the main crop, or in an isolation plot as already described.

In the accompanying diagram, which shows the process graphically, it can be seen that in any one series seed for the main crop is produced

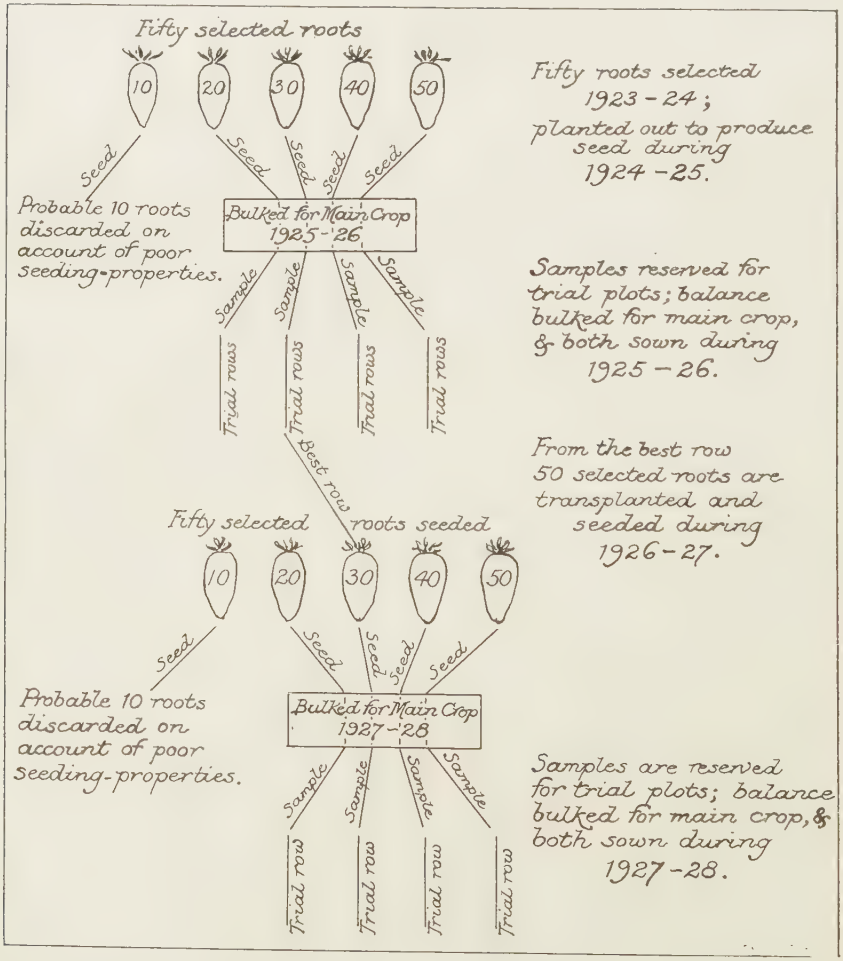
Fifty selected roots
10
20
30
40
50
Seed
Probable 10 roots discarded on account of poor seeding-properties.
Bulked for Main Crop 1925-'26
Sample
Trial rows
Best row
Fifty roots selected 1923-24; planted out to produce seed during 1924-25.
Samples reserved for trial plots; balance bulked for main crop, & both sown during 1925-26.
From the best row 50 selected roots are transplanted and seeded during 1926-27.
Fifty selected roots seeded
Probable 10 roots discarded on account of poor seeding-properties.
Bulked for Main Crop 1927-'28
Trial row
Samples are reserved for trial plots; balance bulked for main crop, & both sown during 1927-28.

FIG. 1. DIAGRAM SHOWING METHOD OF ROOT SELECTION AT THE MOA SEED FARM.

only in alternate years. This difficulty can be overcome by having a parallel series commencing one year later, or, what is very much simpler, by producing each year sufficient selected bulk seed to allow for planting two main crops.

Onions are far better transplanted in the autumn, after they are thoroughly dry and ripe, but with the hard Central Otago winter we prefer to plant our selections in the spring. Brown Spanish, which is our standard variety, is difficult to select, because the colour of the skin has, we believe, never been fixed.

ANNUAL ROOT CROPS.

Radish is the only annual root crop we have grown at the Moa Farm commercially. Its extreme liability to cross-pollination renders it unwise to grow more than a single variety on any one farm. The method of selection we adopt is the same in principle as that used in the case of biennial roots. The roots, however, are lifted a few weeks after sowing, when the radish is in proper state for eating. Trial rows are judged for flavour, quality, and appearance, and the selected roots are topped and immediately transplanted. They will recommence to grow at once if the soil is moist or the roots are watered after transplanting.

GARDEN PEAS.

Some thousands of acres of garden peas are grown annually in New Zealand on contract, and the firms who let out these contracts employ gangs of men who travel from one farm to the next roguing the crops. The roguers sweep across the paddocks, pulling up all plants which are not of the correct type; and a man trained to this work can pick a remarkable number of rogues out of an apparently pure crop. While this is the approved method, we are doubtful if the expense is warranted by the results obtained. After our first year of roguing on these lines we decided that it would be more effective to devote our whole attention to a small area to be harvested and threshed separately for our own sowing. This, combined with hand picking of seed in winter, resulted in a certain amount of improvement. We believe, however, that it is almost impossible to thoroughly rogue a block of peas, even when these are grown in drills, and that more definite results would be obtained by going through the crop and hand pulling a large number of plants of the correct type. The seed from these would be sown in an increase plot, the produce of which would be sown out for the main crop. We have not tried this method, but having tested many others we believe this to be the most practicable. The ideal, if not the most practicable method, is to raise strains from single-plant selections. This work we commenced in 1920–21, but we are not likely to have sufficient seed of these strains for sowing our main crops till the season 1925–26. This delay is largely due to the slow increase in peas. While, for example, in an average crop oats may yield forty-fold, peas yield only eight-fold. The delay is also in part due to the almost complete failure of the pea crops during the season 1923–24.

The procedure in the case of annual crops is quite simple and straightforward. Selections are made from a main crop, and the seed from each plant is sown the following spring in an individual row. The seed is multiplied from year to year, keeping each strain separate, and

eliminating any which show poor qualities. With peas the process is slow, but we have been able to produce strains which so far have bred quite pure, and for which there should be a good demand at high prices.

Threshing operations are a fruitful cause of varieties becoming mixed; and, indeed, it is not practicable to clean thoroughly the large threshing-mills in common use. To minimize this trouble special mills would have to be built, affording access to all parts, and all ledges bevelled off to allow of no angles and corners on which seed could rest. Apart, however, from the mixing of varieties, peas are inclined to rogue in various ways.

Round peas in a wrinkled variety are a constant source of trouble. They may be due to the presence of a foreign variety having round seeds; on the other hand, they may arise as "sports" in the variety. Round peas picked out of William Hurst, and sown, produced a variety of types, but all round-seeded. We continued to grow the most promising type, and it has developed into a fine-type round-seeded dwarf pea, similar to if not identical with Country Gentleman. A single plant-selection of Dwarf Defiance produced a plant some of the seeds of which appeared to be somewhat round, and the rest wrinkled. The wrinkled and partly round were therefore sown separately, but very few of the wrinkled grew, and these produced entirely wrinkled seed. The partly round or dented seeds produced mainly wrinkled or dented seeds, but there also appeared some perfectly round light-blue peas similar in every respect to the round pea which forms so common an impurity in this variety.

A type of rogue very common in peas is one producing "tare" leaves. The plant develops very prominent tendrils, the leaflets are small, the stipules pointed, and the pods curved. They are generally considered to be degenerates, but we have not had any of our selections producing tare-leaved plants. We did, however, sow the seed of two tare-leaved plants, thinking that they might throw some light on the appearance of round seeds, but they produced, without exception, wrinkled seed.

Stratagem pea has probably never been fixed to the extent that other standard varieties have. It produces, in common with Dwarf Defiance, a rogue that branches well and produces a large number of pods. The pods are flat, blunt-pointed, and light-green in colour; the seed is very wrinkled and of light bushel-weight. At first sight they appear to afford promising material for selection, and we made selections in January, 1921. During the following season they showed very promising results, but in 1922–23 one reverted 3 per cent. and another fully 50 per cent. to the Stratagem type. Curiously, however, our pure lines of Stratagem and Dwarf Defiance have shown no tendency yet to throw these rogues.

SWEET-PEAS.

We grow annually over one hundred varieties of sweet-peas, and any attempt to make a number of selections from each for comparative trials would break down under its own weight. The best we could do would be to select from a few varieties each year. The method we adopt is to go through each variety very carefully, and any plant producing blooms of exceptional merit is marked by being staked and

tied apart from the rest. Every variety that we grow is named and numbered, and has a bag and a hook similarly marked in the drying-shed. Each of these bags contains a tin, and when a variety is being picked any ripe seed from the selection is placed in this tin and reserved for sowing the following season. By adopting this simple method we have brought about considerable improvement and greater uniformity than that observed in any seed we have bought. In sweet-peas only have we carried out any cross-breeding with a view to raising new varieties, but this work would be of little interest to agriculturists.

POTATOES.

We have grown during the last few years a very large number of potato varieties, both of local and of English and Scottish origin. Our main-crop varieties are Robin Adair, King Edward, Sutton's Supreme, Up-to-Date, Sutton's Abundance, and Arran Chief. Of the more recent introductions we have had promising results from The Rector, Arran Victory, Great Scott, Arran Comrade, and Kerr's Pink.

In 1921 we made a number of hill selections from Arran Chief, and have this winter sufficient seed for planting our main crop next spring. This seed will be the progeny of the tubers of a single hill selected in 1921, and which has successfully competed against all the other hill selections. The best we can say for this selection, however, is that it is a pure strain of average yielding quality. Our failure we would not attribute to the principle of hill selection, but rather to faulty selection on our part. The potato, being reproduced from its tubers or modified stems, exhibits little variation upon which to base selection, except in the very rare case of "bud sports." A heavy-yielding hill will not necessarily transmit its yielding quality; it has, in fact, been demonstrated that an average-yielding hill will reproduce more freely than a heavy hill. It is frequently observed, however, that potatoes "run out." This is probably a pathological condition brought about, in part at least, by diseases of which very little is known—for example, mosaic, as well as others that are better known. As some of these diseases are transmitted from year to year, hill selection affords an excellent method of producing disease-free strains—a matter of far-reaching importance in the potato. Were we to succeed with hill selection or tuber-unit selection, as others have before us, we would expect that the measure of our success would be the degree to which we had produced pure strains, free from those diseases to which is attributed "running out."

Seedling Potatoes.

A large number of seedling potatoes in their second and third year were sent to the Moa Farm by the Department of Agriculture. They were originally raised by Mr. J. Beverley, late plant-breeder at the Central Development Farm, Weraroa, and comprised the following crosses: Gamekeeper × Patterson's Victoria, Gamekeeper × Sutton's Bountiful, and Up-to-Date × Ngatiote.

These seedlings are now in their fifth and sixth year, and during the interval a very large number have been discarded. We are concerned only with selection for commercial purposes; but, even so, we find it necessary to take full notes on each seedling both during its growth and at harvest. After the first year we were able to group

them into types, and by planting all of one type together we are able to make better comparisons and eliminate more readily.

At harvest we sort and weigh the tubers of each as table, seed, and pig potatoes. To enable one yield to be more readily compared with that of another we calculate what we term a yield-factor according to the following formula : $\frac{\text{Table} \times 2 + \text{seed}}{N}$. Where N equals the number of shaws in the row, or, in the case of very long rows, we make calculations on ten or twenty shaws at intervals. We double the table potatoes because we consider, from a commercial point of view, the table sort to be of proportionately greater value than the seed. This also enables us to group them according to yield, and though we make no hard-and-fast rule we generally discard any with a yield-factor below 1, or any which we consider to be of no commercial value. The remainder we treat as follows :—

Yield-factor	.. 1 to 2	—plant out	10	tubers.
,,	above 2 to 3	,,	20	,,
,,	,, 3 to 4	,,	30	,,
,,	,, 4 to 5	,,	40	,,
,,	,, 5 and over	,,	50	,,

At the present time we have about half a dozen seedlings which we are increasing with a view to further trials in different districts, and, if successful, placing them on the market. Cooking-tests of all the most promising will be carried out this winter.

We are, in common with other potato-raisers, beset with the danger of producing a seedling similar in appearance and habit to a variety already named. In our lists of synonyms, taken from the records of the English and Scottish synonym trials, we have a list of over one hundred varieties synonymous with Up-to-Date, and we quite expect to discard some of our seedlings for similar reasons. In fact, the most promising seedlings of the 1922–23 trials prove to be identical in appearance with Great Scott, and one of the most promising in the 1923–24 trials to be very similar to Arran Comrade.

OBJECTIVE AT THE MOA FARM.

In concluding the plant-selection part of these articles the writer would like to point out that such work as we have done at the Moa Farm has been with a definite commercial objective. Though often tempted, we have refrained from experimenting along lines of purely scientific interest unless we could see that it might lead us to information of direct value in the commercial production of seed. For a similar reason we have not endeavoured to produce new varieties, except to follow up certain pure strains of peas. We consider, in fact, that there are far too many varieties already on the market, and our aim has been to grow and try to improve recognized standard varieties. We must, however, except sweet-peas, for in this case the varieties change as the fashions, and it is imperative for us to raise new varieties by cross-breeding in order to keep abreast of the times.

(To be continued.)

THE RELATION OF BIRDS TO AGRICULTURE IN NEW ZEALAND.

X. THE KEA OR MOUNTAIN-PARROT.

J. G. MYERS, Biological Laboratory, Wellington.

THE highlands of the Old World have their eagles to inspire the enrichment of folk-lore with tales of avian daring and rapacity, of children carried to inaccessible heights; the Alps of Switzerland find the embodiment of their own far-soaring grandeur in the famous *lammergeier* or so-called bearded vulture; the Andes afford fit resting-place among their fastnesses to that greatest of all the birds of prey, the condor. It remained for the New Zealand Alps to appoint a genius loci over their solitudes, and to choose in accordance with the uniqueness of the native avifauna. No birds of prey were here appropriate to the task; the gigantic eagle of the ancient days is gone, and a parrot lords it over the mountain-slopes above the forest. The parrots, those brightly plumaged bird pets of the world, seem vividly incongruous with the austere topography and rigorous climate of the heights; yet who shall say the subject of this article, winging its powerful flight over the highest ridges or echoing its weird and melancholy call of "kea, kea" across the gorges is not in keeping with the magnificent desolation of the scene.

Such a haunt for a parrot is sufficiently remarkable to have rendered the kea famous in the annals of bird-lore; but the early reports of its alleged sheep-killing made it notorious throughout the world, till not a popular natural history could be published without a reference to the mountain-parrot of New Zealand and its unparalleled change of diet from grubs and berries to live sheep; until not a museum in the Dominion was complete without a caricature of a mangled sheep gory with sealing-wax blood, and a stuffed specimen of the unholy bird engaged in its feast.

In the mind of the man in the street this, then, is the position regarding the kea. It is the aim of the present writer to sift the available evidence and to present the data on which a strictly scientific opinion can be based. At the outset it must be admitted that the evidence collected since the first rumours of sheep-killing in the "sixties" is meagre in the extreme, and affords a striking illustration of the scanty and shiftless foundations which often suffice to support a colossal edifice of popular theory. The information is at present totally insufficient to enable anything more than a few guarded conclusions to be drawn, and a few suggestions to be made as a basis for future investigation of one of the most pressing problems New Zealand has to offer in economic ornithology.

THE BIRD ITSELF.

Seen at close hand the kea (*Nestor notabilis* Gould) is a sizable bird, about as large as the New Zealand wood-pigeon, but of a different build. The beak, with the long curved keen-pointed upper mandible, at once attracts attention by its powerful aspect and sinister

appearance. To the worst that has ever been said against the kea its beak will never give the lie. The plumage, olive-green with black edges to the feathers, possesses a quiet beauty of its own, enlivened with a vivid charm when the act of flight displays the gorgeous red feathers lining the wings and covering the base of the tail. The legs are longer than those of its exclusively forest-dwelling but closely related cousin, the kaka (*Nestor meridionalis* Gm.). Extra length of leg is often an adaptation to ground-dwelling habits, and *vice versa* the most aerial of birds—petrels, swifts, humming-birds, and so forth —possess the shortest legs. The differences between the sexes in the kea are not striking, but the male is said to be recognizable by its longer and more powerful beak.

The mental characteristics of the kea are fully in keeping with its systematic position as a member of the parrot family. No traveller in its haunts fails to remark on its never-failing curiosity and engaging familiarity. Its innate playfulness is tinged like that of a puppy with mischief, and tempered with a wile beyond the wisdom of birds. In the neighbourhood of camps it is often a decided nuisance from its depredations on tents and equipment.

BIOLOGY.

Of the life-history of the kea suprisingly little is known. Even at the present day very few naturalists have ever seen a nest. There is therefore little agreement even on such a simple question as the number of eggs laid. Thus, some will have it that there are never more than two eggs, while others state that they have found as many as seven. Taking everything into consideration, it seems probable that Mr. A. F. O'Donoghue's estimate of four to six, founded largely on personal experience, is as correct as any one's. The time of nesting and the number of broods per year are also doubtful. Marriner in his book on the kea, after stating somewhat dogmatically that "the kea's breeding season commences about June, and is continued on to September or even later," and even building one of his most favoured theories of the origin of the sheep-killing habit partially on this alleged fact, shows elsewhere that Mr. E. F. Stead found a nest in January. There is, of course, nothing inherently impossible in the assertion that the kea nests in midwinter — the Emperor penguin chooses this of all seasons in the Antarctic, as do also very frequently several species of shags in New Zealand. Many more authentic observations are required, however, before the evidence for such a habit can be considered established in the kea's case.

Uncertainty concerning the nesting-habits of the kea has been engendered largely by the inaccessibility of the site. The pure-white eggs, about as large as a pigeon's, are laid in holes in the cliffs or crevices among the rocks, often in such positions that even if located the nest remains out of reach. Finally, when all other difficulties are overcome it may be found that the actual breeding-chamber is at the end of a tunnel so long that even a crow-bar is insufficient to force an entrance. For this reason, if for no other, it is probable that the kea will ever survive in its mountain home. In this connection Dendy writes: "It is highly instructive . . . to contrast the condition of such a bird as the flightless parrot, or kakapo, with that of its relative the kea. The

FIG. 1. THE KEA (NESTOR NOTABILIS).

This photograph was taken under difficult conditions, and the bird's head and beak have been somewhat unduly reduced in size by the camera. The head of the kea, in general, is decidedly large in proportion to its body.

[Photo by H. Drake.

kakapo is a large, heavy bird of nocturnal habits, and with practically no means of defence; it haunts the dense forest, and is rarely seen except when hunted out by dogs. The kea, on the contrary, is one of the strongest fliers of the parrot tribe. It frequents high and more or less inaccessible mountain regions, and since the advent of the Europeans has learnt to make use of the sheep which they have introduced as an additional food-supply. It is doubtful whether the utmost efforts of the sheep-farmers, who annually spend large sums of money for the purpose, will ever enable them to exterminate the kea, and it

is equally doubtful whether the efforts of the New Zealand Government to preserve the unique flightless birds will suffice to prevent the complete extermination of the kakapo within the next few years."

The haunt of the kea is essentially subalpine. It is found only in the mountains of the South Island. On these its chief habitat comprises the open country just above the bush-line. Here it is that the present writer has observed it, and the experience of other naturalists is similar. Thus Park writes: "The kea is seen at all altitudes above 2,000 ft., but its favourite haunt during the daytime is the grassy mountain-slope above the bush-line. At night it perches on the limbs of dead trees at the upper edge of the forest, somewhere about 3,000 ft. above the level of the sea. In stormy weather the kea will occasionally descend to the floor of the mountain valleys, and perch at an altitude of 1,000 ft. or somewhat less above the sea." L. Cockayne, after a wide experience of the kea, states: "Although frequently met with on the open alpine and subalpine hillside, I consider the bird essentially one of the forest limit, where it may be seen in numbers at the junction of the forest and subalpine meadows and in the *Nothofagus* forest where such are pierced by river-beds." Stragglers may even venture down practically to sea-level.

The question as to what constitutes the natural food of the kea is one of considerable interest, and is fortunately one on which more reliable data are available than on any other aspect of the kea problem. Marriner's account is good, and may be quoted with advantage:—

> The kea, like other parrots, is normally a vegetarian, with, as one might expect from its connection with the brush-tongued parrots, a strong liking for honey. In addition to this it is strongly insectivorous, being specially fond of the larvæ of the insects found on the mountains.
>
> The late Mr. T. H. Potts says that the kea gathers its subsistence from the nectar of hardy flowers—from the drupes and berries of dwarfed shrubs that contend with the vigorous climate and press upward almost to the snow-line of our alpine giants. To these food resources may be added insects found in the crevices of rocks, beneath the bark of trees, &c. . . .
>
> When the snow covers the subalpine shrubs, or insect-life is dormant, the kea is forced to go lower and lower down the mountain to take shelter in gullies, where it feeds on the hard bitter seeds of kowhai (*Sophora tetraptera*), small hard seeds in the fruit of *Pittosporum*, the black berries of *Aristotelia fructicosa* (the native currant), as well as on the fruit of the pitch-pine (*Dacrydium biforme*), and the totara (*Podocarpus totara*). . . . Professor W. B. Benham, when in the Southern Alps, saw some keas eating the orange berries of the low-growing heath, *Leucopogon Fraseri*. He says: "Two birds were feeding on these berries within two yards of where I was sitting; they ate the juicy part of the berry, putting out the skin, and usually the 'seed' also, which I found afterwards on the ground, though now and then I heard the bird crack the seed; so that occasionally, at any rate, it swallows this."
>
> A correspondent writing on this subject says: "I have watched the kea pecking grubs out of a dead tree, and have frequently noticed them pecking into the earth for the roots with their beaks."
>
> Another says: "I have shot very few [keas] that have not had mutton in their crops, and next to that some grubs and the roots of aniseed. In summer and autumn they go for berries such as snowberries, &c., and also the honey out of the flax-seed (*Phormium tenax*)."

Other observers found the kea feeding on the roots of spear-grass (*Aciphylla* spp.), of so-called mountain-lily (*Ranunculus Lyallii*), and of mountain-daisies (*Celmisia* spp). Mr. A. Philpott has paid attention

to the food of the kea. He states: "In January, 1917, the mountain-flax (*Phormium Cookianum*) was in flower, and little flocks of keas might daily be found sucking the nectar from the blossoms. On more than one occasion keas were observed breaking off and splitting up the flower-stalks of the celmisias. The soft central portion of the stalk seemed to be the part desired, for though I examined the refuse in order to ascertain if it was caterpillars or some other form of insect-life that the bird was after, I could find no trace of such. The gizzards, however, of a few which were captured showed that insects formed a large proportion of their food, remains of the larvæ of Cicadæ being plentiful. Though the kea may often be seen stripping off the lichen and moss from the branches of trees, the bird does not seem to bore into and break up decayed wood as its congener the kaka does; probably *Nothofagus* logs do not contain sufficient insect-life to make it worth while."

The present writer and Mr. Esmond Atkinson (this *Journal* for May, 1923) have previously emphasized the large proportion of forest plants producing berries which are eaten (and the seeds thus dispersed) by birds. As the subalpine plants are not behindhand in this respect, the kea has at certain times of the year a plentiful food-supply.

A question of great importance in kea biology has yet to be mentioned—namely, the bird's movements. There is, of course, good evidence that heavy weather on the heights will drive keas to lower levels, but a matter that needs investigating is that of more extensive migration. It is frequently asserted that reserves and mountainous back country act as centres in which keas may retire to breed, and from which they sally forth over wide areas to harass the sheep. On the other hand, nearly all available data point to the conclusion that except for oscillations in altitude consequent on meteorological conditions the keas of a given area are resident, and do not seek food over wide tracts of adjacent country. Further information on this point is eminently desirable.

DISTRIBUTION.

The kea occurs nowhere else in the world but in the mountains of the South Island of New Zealand. Formerly, as indicated by the finding of fossil bones, it inhabited also the Chatham Islands, while if Maori tradition be correct it was once found in the Urewera country of the North Island, from which district it apparently disappeared before the advent of the Europeans. According to Best, the Maoris describe it as smaller than a kaka, brown or reddish, with a different beak, and state that it lived in the open country.

Be this as it may, the kea is certainly now confined to the South Island. According to Marriner, "wherever there is mountainous country in the South Island, with the exception of the Kaikoura Mountains in the north-east, the kea can be found." It is now, however, more plentiful in the Marlborough District than when Marriner wrote.

There is a considerable body of evidence to show that the kea has extended its range since it was first discovered. This extension has taken place largely in a northerly direction. For example, the first keas to be seen in northern Nelson were not observed till 1903–4, and even now, though an occasional bird is seen, they are not common.

The explanation of this spreading is not easy to find. Marriner, however, suggested that increased food-supplies in the form of dead sheep (the proof that the kea eats carrion is undoubtedly complete) led to a multiplication of the species and consequent overflow into districts hitherto not frequented. On the other hand, the backbone range of the South Island still remains the stronghold of the kea, and most of those seen in distant localities are probably stragglers which may previously have escaped notice under conditions of sparser settlement.

HISTORICAL.

The history of the kea since its discovery may be considered under the following headings :—

(1.) Period of ornithological interest only (1856–67).
(2.) Period of suspicion (1867–70).
(3.) Period of traditional condemnation (1870–99).
(4.) Period of critical investigation (1899 and onward), initiated by L. Cockayne.

In 1856 Mantell while exploring in Southland discovered this new mountain-parrot, and it was soon afterwards described by Gould, Australian ornithologist. Little did Gould dream when he named it *Nestor notabilis* how notable it was destined to become.

The story of the first suspicions of sheep-killing may be told in Marriner's words :—

> When killing sheep for home consumption, on the Lake Wanaka Station, north-west Otago, in 1867, the shepherds noticed from time to time what they took to be a new disease on the loins of the animals, and during shearing, in 1868, these mysterious scars were again observed. On close examination the supposed disease revealed severe wounds in different stages of healing or festering. On some sheep there was merely a patch of bare skin, but on others there was either a half-healed wound or a raw patch of festering flesh, while others, again, had each a large hole torn in the side, from which the entrails were often protruding. . . . Suspicion fell at once on the black-back gull and the harrier-hawk, but it was soon pointed out that it was only the sheep of the alpine country that were attacked, while the gulls and hawks scoured the plains as well as the mountains. It was a well-known fact that the gulls would pick at the eyes of a very young lamb, or even at a sheep when it had fallen, but they had never been known to attack the sheep over the loin in the manner of the unknown culprit.

This began a period of suspicion, and suspicion very soon in the popular mind crystallized into dogmatic certainty, as keas were first seen picking meat and fat from skins and from carcases, and were observed feeding on the bodies of dead sheep. Finally it became generally believed that shepherds had watched the birds actually attacking the living animals. Incredible as it may seem, there was, however, up till 1907 not a single recorded case of a witness who had actually seen a kea attacking a sheep. Nevertheless the statement was circulated throughout the world, received general credence, and in New Zealand became an article of national faith. Even Buller wrote that the depredations of keas were forcing sheepowners to give up their lands.

The first to question publicly the evidence—but with a quite open mind—for the accepted theory was Dr. L. Cockayne, who asserted in 1899 (given as 1905 in Marriner's book) before the Philosophical Institute of Canterbury, after considerable experience of kea country : " I have never seen it attack sheep, nor have I ever met with any one—

shepherd, musterer, or mountain traveller—who has done so; the most that my inquiries have elicited is that sheep are found from time to time with holes in their backs, and that keas have been seen hovering round sheep." In the general discussion that followed no one was able to offer any more direct evidence.

This occasion initiated that period of critical investigation, the first-fruits of which were two notable contributions to the subject in the form of a paper by Benham and another by Marriner, both published in 1907. In the former are reproduced the accounts of some ten eye-witnesses, while in the latter over thirty sheepowners and shepherds are claimed to have actually seen the kea at work. It is, however, noteworthy that Marriner, although he made a special investigation of the whole matter and spared neither time nor pains to see for himself, gained not a particle more of first-hand evidence than was afforded by the bodies of several sheep said to have been killed by keas.

Marriner's paper was later published in book form under the title of "The Kea: A New Zealand Problem." This has now become an authority in the popular mind on the kea and its habits, although the article on which it was based contained more detailed information, and, in company with Benham's paper, should really be considered the standard reference work. An examination will presently be made in detail of the evidence adduced in these publications.

For a considerable period previous to 1906 the subsidy on kea destruction paid by the Government (and often increased by the subscription of local bodies or of sheepowners themselves) was 6d. per head. From 1906 till 1920 the Government paid 1s. per beak, but in the latter year the subsidy was raised to 5s. For the six months before the increase payment was made on 927 beaks; for the six months immediately following 1,388 were brought in. The added impetus given to kea-hunting by the augmented price is a significant fact. The number of beaks paid for by Government in the financial year 1923–24 was 4,023; in 1923, 3,584; and in 1922, 6,315.

SHEEP-KILLING.

As we have already seen, the recorded evidence against the kea up till 1907 was not only circumstantial merely, but so utterly flimsy and founded on hearsay that it could be considered seriously only as an indication that the matter was worth investigation. But such investigation was not thought of until 1899, and it yet remains to be carried out with the proper methods of biological inquiry.

Considering first the evidence against the bird we find this nearly all collected in the works already referred to. Marriner sums up the points of agreement among the eye-witnesses who communicated with him, and writes as follows:—

> Usually one or two old birds, known as "sheep-killers," do the killing, and the others share the spoil. It is quite a mistake to suppose that all keas kill or even attack the spoil. Just as we have comparatively harmless tigers, who will not attack man except under provocation, and also "man-eaters," who seem to take a special delight in killing men, so, among the keas, many of them never attack sheep, while others, usually old birds, seem to enjoy nothing better. . . .
>
> The usual mode of attack seems to be as follows: The bird settles on the ground near its quarry, and, after hopping about here and there for some time,

leaps on to its prey, usually on the rump. If it cannot obtain a firm grip with its claws the movement of the sheep may cause it to fall, but the kea seems rather to enjoy the sensation, and so tries again until it has securely perched itself on the sheep's back. Then the murderer begins to cruelly pull out the wool with its powerful beak, until it gets down to the flesh. The sheep, which for some time has been moving uneasily about, gives a jump as the beak enters the flesh, and then commences to run wildly about here and there in vain efforts to rid itself of its tormentor. When, however, the poor beast discovers that it cannot dislodge its enemy it seems to lose its head, and rushes blindly about, usually at a high speed.

Sometimes the birds run the sheep to death, and then gorge themselves on the dead body. At other times they never reach a vital part of the animal's anatomy, but after severely wounding it they leave it, and the poor brute wanders about with a large gash, sometimes 4 in. or 5 in. across, on its rump, and torn open so much that the transverse processes of the vertebræ can be seen. The sheep struggles along until blood-poisoning, caused by filth and exposure, sets in, and the unfortunate beast lies down and gives up the struggle.

Marriner himself saw "three sheep that had been attacked in this way by keas." In one "there was an ugly wound on the rump about 11 in. from the base of the tail, the gash measuring 4 in. by 5 in. in width and about 2 in. deep. One half had been torn down to the sinews, while the lower half was eaten down to the bone; the body cavity, though just pierced, did not seem to have been disturbed." It should be mentioned that worse wounds have been described in which portions of the intestines had been actually dragged through the holes. Marriner further writes:—

The greatest damage is done to flocks in winter, when the country is snow-bound. In the mountainous regions the sheep are usually kept down on the lower country until the mountains get a good coat of snow, for once the tops are covered there is very little danger of the sheep going far in the snow. However, if the sheep have been allowed to remain on the tops of the ranges until the snow comes, as is sometimes the case on a big run, they gather together in a basin near the summit and are buried by the snow. It is at this time that the kea finds them an easy prey. . . . Winter and early spring are the periods of the year when the keas are most aggressive in their attacks on sheep, and this fact seems to intimate that the lack of ordinary food does much to instigate the attacks, for a heavy winter generally means a heavy loss of sheep, apart from accidental losses. . . . Not only is food scarce in winter, but the sheep are easier to kill, for the heavy snowstorms which cover the country bury or half bury a large number of sheep, and as they are in many cases unable to move they become an easy prey to the hungry birds. . . . Their attacks, however, are not altogether confined to any special time, for they have been known to attack sheep at all seasons of the year. Still, from what I can gather, autumn seems to be the time of fewest attacks. No doubt the plentiful food-supply, and perhaps the fact that the sheep have been shorn, thus giving the birds a poor hold on the animals' backs, account for this. . . . All my correspondents agree that the favourite times of the day for the bird to commit his depredations are the early morning and the evening; for, like its cousin the kaka, whether killing sheep or not, it is always lively at these times. For this reason it is difficult to obtain photographs of the birds actually attacking sheep, for the lack of light and the absence of the shepherd at these times make the chance of obtaining a snapshot extremely small. They have been known to attack at all hours of the day, but they seem to confine most of the work to the early or late hours. When attacking in the middle of the day it is nearly always in dull or foggy weather, though rare cases are known of their killing sheep even in bright sunshine.

The rump is chosen as the point of attack apparently because it offers a firm and convenient perch, and not because the bird has any special liking either for the kidneys or the kidney-fat. The crude traditional belief, as accepted and widely popularized by various writers, was that the kea chose the kidneys as a special delicacy and always sought out these organs. As a matter of fact, it is said

to eat them very rarely indeed. The same theory held that the kea was led to attack sheep from their resemblance to those huge mountain cushion-composites (*Raoulia* and *Haastia*) commonly known as "vegetable-sheep," from which the bird obtained its primitive and innocent repast of grubs and other insects. This ingenious hypothesis has been severely criticized and is now no longer held. Not only has the resemblance of these plants to sheep been greatly exaggerated, but according to Marriner they are not torn open by keas in search of food, nor, further, do they occur in the regions where the bird was first accused of sheep-killing.

Hunger and that insatiable curiosity which has been so often remarked are now considered to have been the chief factors in leading the kea to attack sheep. Reischek is the author of the very probable suggestion that long-dead carcases infested with maggots were first visited by keas for the sake of these insects; then the carrion itself was eaten, and finally the living sheep, especially if bailed up by the snow, were attacked. It is also well known that skins hung on fences and meat suspended from gallows are visited by these birds and also by white-eyes and kakas for the sake of the fat. The beginning of the habit may be readily comprehensible—indeed, the wonder would have been had the kea not paid any attention to the sheep as a source of food.

Perhaps the most conclusive evidence adduced since the publication of Marriner's work is afforded by a small photograph in the possession of the Lands and Survey Department. This shows a live sheep with a hole in the neighbourhood of the loins and one kidney visible, apparently having been half pulled out.

In estimating the damage done by keas some most exaggerated statements have been made. Marriner, however, after studying all the evidence, stated: "Reckoning over the whole kea-country, I am certain that 5 per cent. of the flocks would well cover the annual loss due to keas." But at the outset it must be emphatically maintained that, as the birds eat carrion, all dead sheep found with wounds similar to those usually attributed to keas are not necessarily killed by keas. It has so long been the custom in kea districts to write off a very big proportion of the annual loss of sheep as due to keas that the loss due to other causes, notably to the rough nature of the country, appears to be largely overlooked. Guthrie-Smith, writing as a sheep-farmer of lifelong experience and a scientific observer of unimpeachable accuracy, states: "In a well-managed, well-fed; and carefully culled flock running on perfectly safe country, 2 or $2\frac{1}{2}$ per cent. is about the normal death-rate. It is the unavoidable loss incurred through diseases more or less akin to those causing death in the human race. On Tutira, however, a minimum loss of 5 per cent. has never been quite reached; it is the toll paid by the station to cliff and bog. . . ." Tutira is in northern Hawke's Bay, in country which, though including an area of deep gorges, cannot be compared for general roughness with the average of sheep-stations in the regions inhabited by the kea. In these regions the musterers are necessarily mountaineers, and there can be no more precipitous country carrying sheep in the world. It would be interesting to know just how much of the high death-rate due to these abnormal conditions and to the rigours of the mountain winter is attributed to the kea.

It is always difficult to prove a negative, but having shown the evidence indicating the kea as a killer of sheep we now proceed to examine the witnesses for the defence. Cockayne's remarks have already been quoted, and it may be safely asserted that in every case, save one, when an impartial investigator has relied on his own observations, the result has been in entire agreement with Cockayne's statements. The single exception is that of Marriner, who saw three dead sheep which were alleged to have been killed by keas.

Professor James Park, in a recent geological bulletin, writes as follows :—

> In his travels in this and Lake Wakatipu regions the author was unable to gather from the runholders or the shepherds any evidence that would substantiate the charge of sheep-killing laid at the door of this bird. In the summer of 1880–81, while assisting Mr. Alexander McKay in a geological reconnaissance of the Ohau, Wanaka, and Matukituki country, diligent inquiry among the shepherds failed to disclose any satisfactory evidence of the rumours then beginning to find their way into the newspapers which credited the kea with sheep-killing. In every case that was investigated the bird was found guilty on second-hand evidence alone. Though keas are plentiful in the Tasman Valley, the guides at Mount Cook Hermitage assert without hesitation that the kea is no sheep-killer in that region. Possibly there may be parts of the Canterbury mountains where the kea has developed an appetite for mutton, but in every case the evidence should be sifted by shrewd cross-examination. Generally, New Zealand scientists consider that the charge against the kea has not been proven. On the other hand, the runholders are divided in their opinion ; and whether guilty or not guilty the law decrees the kea an outlaw which may be destroyed at sight. The subject is surely one that ought to engage the attention of some unprejudiced investigator.

Mr. A. F. O'Donoghue writes in 1924 that he has collected on the kea field-observations extending over a period of ten years and embracing Westland, Marlborough, the Mount Cook district, the Mackenzie country, and that portion of the Canterbury District which lies along the upper reaches of the Waimakariri River. He says: "During the whole of this period I have missed no opportunity of questioning not only the actual station-owners, but every conceivable person with whom I came in contact, and never yet have I obtained direct evidence of the kea either hunting or attacking sheep. On my first tour through the Mackenzie country I found that the feeling on the subject was greatly divided, but as time went on and the Government and local-body subsidy increased, many converts to the cry of 'death to the kea' were made. . . . This same state of affairs obtained also in the Canterbury districts over which my observations were made."

Nor are the sheepowners themselves even yet unanimous in their condemnation of this bird. Thus Mr. A. Philpott, who himself studied the kea for several years and found no indication of its taking any notice of sheep, wrote in 1919: "The kea is common on the Hunter Mountains, where its numbers seem to be on the increase. Contrary to the experience of flockowners in other localities, Mr. H. Cuthbert, who utilizes Mounts Burns and Cleughearn, informs me that the birds have never to his knowledge interfered with his sheep."

SUMMING-UP.

The position may now be summed up as follows: From the examination of keas' stomachs there can be no doubt that these birds eat mutton. It has been proved also that dead sheep and other

carcases are devoured by them. Finding of mutton in the stomachs is therefore no proof that the sheep were killed by the birds. There is considerable circumstantial evidence, together with direct testimony of sheepowners and shepherds, that keas attack living sheep. But the strongest proof against the kea lies in the occurrence of very peculiar wounds in the neighbourhood of the sheep's loins. Such wounds have been found only in kea-country and can hardly have been produced by any other agency than keas. It may be accepted as provisionally true that some keas do attack sheep. The previously quoted analogy with man-eating tigers is a good one, and the proportion of sheep-killing keas is apparently just as small and the individuals composing it just as abnormal. The kea is still a common bird—in fact, in spite of all measures for its extermination it has apparently increased considerably as a result of the augmentation in food-supply due to the carcases of sheep which have died through natural causes, including possibly some which have been killed by the birds themselves. This being the case, if every or even every other kea attacked sheep to a much less extent than is often asserted sheep-farming would be no longer practicable in affected regions. There is no evidence that keas from other districts—as, for instance, scenic reserves—travel to sheep-country and there commit depredations among the flocks. It usually happens that when the local birds have been thinned or shot out the trouble ceases. The whole question of subsidies is an economic one, and has been too much obscured by unhealthy sentiment on both sides. If the progress of sheep-farming were served by the killing of the innocent along with the guilty; if the trouble among sheep were lessened by slaughtering keas where there are no sheep or where sheep are known definitely not to be molested by the birds, then ample precedent could be found for the justification of such a measure. But is such the case?

NOTE.—The writer is indebted to Mr. A. Ironside, of the Live-stock Division, for assistance in looking up departmental records, and to Mr. Harvey Drake for the accompanying photograph of the kea. Thanks are also due to the Lands Department head-office staff for assistance in referring to their files.

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FOOT-AND-MOUTH DISEASE.

C. S. M. HOPKIRK, B.V.Sc. (Melb.), Veterinary Laboratory, Wallaceville.

FOOT-AND-MOUTH disease is an acute, febrile, contagious, and infectious disease of cloven-footed animals, in the course of which an eruption of vesicles develops on the mucous membrane and the skin, especially in the mouth and in the interdigital spaces. The causative factor is an ultra-microscopic micro-organism. The disease exists in Europe, Asia, North Africa, parts of the United States, and in South American States. Australia, New Zealand, and Canada are still free from infection.

The disease attacks domesticated ruminants (cattle, sheep, and goats) and swine, but has been proved to exist rarely in deer, camels, buffaloes, wild boars, horses, dogs, and even fowls. Human children are slightly more susceptible than adults, usually dying from a gastro-intestinal catarrh. Few humans, however, are ever affected.

THE CAUSAL ORGANISM.

Loeffler and Frosch, in 1897, showed that the organism, in contradistinction to many that we know, would pass through a filter. The organism is found present in the blood generally at first, but later it becomes confined to vesicles and certain lymph-glands. According to Carrée and Vallé, secretions (except urine) are only infective if contaminated with vesicular lymph. There is no sustained proof that any other visible microscopic organism acts in conjunction with the virus. The tenacity of the virus is not of the first order. It is supposed to live in a closed glass phial in the dark for five or six months, but otherwise it is very susceptible to acidity, heating, drying, fermentation, &c. Thus it is killed in cheese or butter by acidity or pasteurization, and at a depth of about 8 in. below the surface in dung-heaps.

Dahmer and Frosch (Germany) claimed recently to have discovered the causal organism of foot-and-mouth disease by means of a special ultra photographic apparatus made by Kohler, of Java, and to have reproduced the disease from various sub-cultures of the organism. They named the latter *Loeffleria revermanni*, after two well-known scientific workers. This claim will have to be confirmed by other investigators before being definitely placed on record as correct.

PATHOGENICITY.

Direct infection: Fresh lymph introduced into the veins of cattle produces the disease lesions in one to seven days, with a dose of 1 c.c. of a suspension of 1 of lymph to 100,000 of diluting fluid. Later the udder and feet are affected. Swine-lymph is more virulent than cattle-lymph. Scarification (scratching) of mucous membranes, with introduction of virus, proves fatal. Artificially dogs and cats are susceptible. Similarly, guinea-pigs are susceptible if scarified on a surface without hair, or if injected intravenously. Rats have proved to be susceptible to injection and to intravenous inoculation, also by living in contact (Beattie, *Lancet*).

Indirect infection: This is common and important, and may be through fodder, litter, stalls, trucks, roads, pastures, markets, drinking-water, attendants' hands, clothes, boots, &c., and possibly hides, wool, manure, and milk contaminated by excretions. There is also the possibility of carriers, such as birds, and this might account for the jumps of the disease for distances of one hundred miles in a day or two. Sir Stewart Stockman and Garnett are authorities for this theory, though objections have been raised by prominent ornithologists. Beattie and Peden, in their experiments on glands from slaughtered cattle which were contact cases of foot-and-mouth disease, found vesicles on the feet and on pleural surfaces of the lungs of rats, containing a virus which seemed identical with that of the disease. Their experiments have not yet been completed. The present outbreak in England has been put down by Sir Stewart Stockman to importation of green vegetables from the Continent of Europe, and of material from the Argentine, where the disease has been particularly rife, but this has not been proved. In Switzerland experiments have proved that the disease will remain on a farm for at least six months, and it is said by Carrée and Vallé in the *Recueil de Médecine Vétérinaire* (September, 1922), that the virus remains for six weeks to eight months in pockets of the hooves of animals which have been affected. These investigators also declare that urine at the beginning of the disease is virulent, and this would appear to be a greater source of contamination of fodder, &c., than other secretions.

SYMPTOMS.

The disease commences with fever—104° to 106° F.—more apparent in young animals than in old, accompanied by an accelerated pulse, diminished appetite, decrease in lactation, and constipation. The temperature subsides with the appearance of vesicles. Then there is, in cattle, a characteristic sucking of the lips and frequent swallowing, with later a smacking of the lips. Saliva is first frothy, then becomes ropy and mixed with shreds of epithelium hanging from the mouth. Foot lesions cause lameness through inflammation of the coronet.

In cattle, mouth lesions generally occur first, followed usually by foot lesions. In cows, udder lesions and lesions of vaginal mucous membrane may also appear. In sheep and pigs, mouth lesions are not so constant, foot lesions being more important. Other regions affected are conjunctiva, trachea, and pharynx occasionally.

The seats of mouth lesions are the tongue (body and tip) and the mucous-membrane lining of the lips and dental pad. These lesions are all vesicular in character, and quite superficial and shallow. The vesicles and ulceration vary from the size of a pea to about 1 in. in diameter. The vesicles burst in about one to three days, threads of epithelium remaining attached for a while. Finally a raw, shallow ulcer is left, which becomes deep only if a secondary bacterial invasion occurs. Healing is by simple ingrowth of epithelium from the sides of the ulceration.

Foot lesions occur at the junction of hair and hoof, and sometimes inside the hoof, especially in heel bulbs and interdigital spaces. They may cause sloughing of the hoof if secondary invasion by other bacteria occurs, or even through confluence of several large vesicles destroying the coronary bands.

Acute catarrhal gastro-enteritis often occurs in young animals, proving fatal. A malignant type may occur, chiefly in old animals, where a form of intoxication develops, showing rigors, paralysis, intestinal hæmorrhage, and finally coma and death.

COURSE OF THE DISEASE.

The disease in the majority of cases takes a favourable course of some five to six days. In mild cases two to three weeks may elapse if the various areas of infection show vesicles simultaneously. Following healing of the local lesions some animals quickly regain their former condition. In unfavourable conditions the animals may die from multiple abscess formation, septicæmia, or intoxication, the result of absorption from the secondary abscesses, &c., which may be formed. The mortality is practically nil from the disease itself, but the after-effects are those which cause so much economic loss. According to Davidson, this is particularly heavy in dairy cattle through the following factors :—

Loss of condition, which in many cases is never regained, or only with considerable expenditure in suitable foods. Winter coats may be carried through as many as three seasons without casting—a sign of a "bad doer."

Milk-yield is greatly decreased for the remainder of the lactation period. Cows usually dry off a considerable time before next calving, and subsequent lactation periods seldom approach the old standard.

Hoof lesions often lead to arthritis, particularly in heavy animals, which have to be slaughtered. It is said that bulls are of little use for service till their hooves have sloughed off, when their vitality is often impaired.

Abortion is a common sequel, or calves at full time may be born dead or die later. Retention of the placenta is common, so bringing about sterility; and a percentage of the young stock born from affected animals prove sterile subsequently.

Mastitis, with loss of quarters, is a common result.

Dislocation of trade occurs, due to veterinary police measures.

DIAGNOSIS AND TREATMENT.

A diagnosis of the disease can be made by the presence of fever and constitutional disturbance, followed by foot or mouth lesions, or both, causing a shallow ulceration. Rapid contagion and simultaneous affection of cattle, sheep, and pigs are factors of great use in diagnosis. In a newly infected country inoculation experiments from one animal to another might be required for confirmation.

Treatment would be impossible in a new country such as New Zealand, nor is it possible in England, where the disease is not always present. Slaughter of all contacts is advisable, and State policy generally provides for compensation for animals compulsorily slaughtered. In older countries local lesions are treated, and in Hong Kong a treatment which had some beneficial result was the intravenous injection of trypan blue for its destructive action on the organism, although harmless to body cells.

PREVENTION.

On the Continent of Europe much work has been done with a view to immunization, but this has not proved effective. Natural immunity following an attack of the disease exists for no longer than twelve months, and even during that period there is no very active immunity. Active immunization with small quantities of active virus from vesicles has not been satisfactory. Passive immunization with large quantities of serum has protected for periods of three weeks, but this method is too expensive for general use in an outbreak. In some parts emergency vaccination is practised so that the disease may be disseminated through the herd at one time, instead of lingering on for weeks. This is only done where the disease is of mild character, not in virulent outbreaks where many deaths occur. It is possible in an outbreak to keep a temperature chart of cattle, and by immediate segregation of animals showing a rise confine the outbreak to a few in the one shed, so preventing a large outbreak.

In Great Britain in the event of an outbreak the regulations provide that notification must be made at once to the Government veterinary officer; that all animal contacts and infected cattle, sheep, and pigs must be slaughtered, either on the farm or in a defined area; that all traffic be suspended at once, the farm itself remaining in strict quarantine for animals; that premises, roads, trucks, &c., over which cattle may have travelled be thoroughly disinfected. In Switzerland persons are also included in this quarantine, which is a very sane procedure.

If the disease is to be kept out of countries not affected, quarantine measures have to be enforced against any other country in which the disease is prevalent, in the matter of importation of stock, hay or straw, packing-material, and animal products such as cow-pox lymph, &c. Quarantine of animals for periods is unsafe for at least six months after the last declaration of the disease in the country affected. In cattle certain animals, according to Loeffler, have been found to be carriers up to a period of seven months.

No successful experiments have been conducted to show the length of time that foot-and-mouth virus will remain on straw under ideal conditions, such as darkness, sufficient moisture, and correct temperature. But, as the organism is so easily killed through desiccation, &c., it does not seem probable that it would last a sufficient length of time to reach New Zealand other than on an infected beast. The greater possibility appears, in the light of late experiments, to be through a rat-infestation of the ship. To be quite on the safe side, however, and until more is known of the carriage of this dreaded disease, it would be necessary to prohibit the entry of any material that might possibly have been in contact with excretions from affected stock.

Perennial Rye-grass Germination.—In the record of operations of the official seed-testing station published in last month's *Journal* it was mentioned that Southern, Canterbury, and Sandon seed for 1924 had shown a distinct improvement on that for 1923. It is of interest to record that the average germination figures of the new harvest for each season are as follows: 1923 — Southern, 77·8 per cent.; Canterbury, 82·3; Sandon, 76·5. 1924 — Southern, 88·9; Canterbury, 93·8; Sandon, 84·3 per cent.

TOMATO-CULTURE.

SOME FURTHER NOTES ON DISEASE-CONTROL.

W. H. TAYLOR (late Horticulturist), Wellington.

WERE it not for the frequency of the occurrence of diseases of various kinds, and the virulence of their attack, the tomato would be about the easiest to grow of all the more important horticultural crops. How far these diseases are avoidable is a most important question, and the means by which they may be avoided is a problem that concerns all tomato-growers. Identification of the various diseases is of little value unless it indicates a line of treatment. How to avoid attacks or to control them when they occur is the thing that matters. The problem must be approached with an unbiased mind if real good is to be done. One must be prepared to find former ideas and practice were wrong, and not to mind it, provided the truth emerges.

In a periodical of the International Institute of Agriculture, about ten years ago, the statement was made that "there is no disease which is inherent in the tomato; every disease from which it suffers is the result of errors in cultivation." This is a plain statement that a good many are sure to dispute, yet evidence is accumulating to prove it right. Those whose memory can carry them back about thirty-five years will remember the first occurrence of tomato-disease in this country. Prior to that time there was no disease; the plants bore abundant crops of quite clean fruit. Diseases began to appear about the time stated; what they were is of little moment, and it is doubtful if any one knew. It is only within the last three or four years that the black-stripe disease has been identified, yet it has been with us for at least thirty years. The organism is now defined as *Bacillus Lathyri*, the same as that responsible for the stripe disease of sweet-peas and for wholesale losses of asters.

The writer is now obliged to refer to personal experience; it is the only experience available to him proving wrong practice to be responsible for outbreaks of disease. He has grown tomatoes every year for forty-five years in the open ground, and for a number of years in a small way under glass. When attacks first occurred it was on plants growing on land to which stable manure had been freshly applied. Plants on ground manured the previous year and that had produced other crops were not affected.* Noticing this, the same practice was followed in after-years, and the same thing occurred. Except in abnormally dry seasons there was no blight until autumn rains fell; then the freshly manured patches were blighted — not the others. These experiments were carried on for ten years, which was considered sufficient for the purpose. Since that time freshly manured ground has never been used by the writer, nor any nitrogenous fertilizers, and blights have never again appeared on his plants. For nine years during which tomatoes were grown in some quantity at the Weraroa State Farm there was

* This safety depends on a moderate amount of manure being used, and a strong-growing prior crop, such as cabbages, being grown. Overmanured land may produce black-stripe disease for several seasons.

no appearance of blight, yet the district is one specially liable to it. It was while at Weraroa—about fifteen years ago—that the writer first recommended this system in the Department's publications, and the same system is advised in Bulletin No. 74, "Tomato-culture," issued in 1918.

BLACK-STRIPE.

It was not until four years ago that the writer fully experienced the value of potash in combating tomato-diseases. Being called upon to advise treatment for black-stripe, which was killing plants wholesale in a large tomato-house, and considering that the strong growth and deep green of the foliage indicated too much nitrogen, also knowing that potash in sufficient quantity will arrest growth, applications of sulphate of potash were advised. The advice was acted on, and the plants were saved, the house giving the best returns in the district. In recent years it has been proved that great losses have occurred where stable manure has been liberally applied, and that sulphate of potash used in large quantities can save the plants even in such cases. It may be mentioned here that spraying has no effect on black-stripe.

The first information about black-stripe from overseas was found in the *Canadian Horticulturist* for April, 1922, in a report by Dr. R. E. Stone, Guelph. The next information received was in a paper on tomato-diseases by Dr. W. Bewley, Director of the Lea Valley Experimental and Research Station, Cheshunt, England. This report may be said to have been identical in its findings with that of Dr. Stone, but added to it by defining the disease as *Bacillus Lathyri*. Both these reports confirmed the views of the present writer (and promulgated by the Department) regarding stable manure and nitrogenous fertilizers in relation to tomato-culture. Space restrictions preclude quotations here, but full extracts were given in an article on tomato-diseases published in this *Journal* for February, 1923.

SLEEPING-DISEASE.

Until recent years sleeping-disease of tomatoes was held to be caused by the fungus *Fusarium Lycospersici*. It is now held that the chief infection is caused by *Verticillium albo-atrum*. Specimens have been so identified at the Department's Biological Laboratory, and there is little cause to doubt that this is the chief sleeping-disease in New Zealand. It is important that the right identification be made, for, according to the English report previously referred to, the organisms occur in opposite conditions—*Verticillium* with low temperatures and *Fusarium* with high temperatures. Thus it is stated that *Verticillium* is distinctly correlated to early planting, and the best means of control are to delay planting to a date later than has been normal. This is quite in accordance with experience here; plants set out at the correct time, but which many consider late, are rarely affected by sleeping-disease. In this connection it should be understood that the trouble does not always show as an early infection; it may not appear till a cold spell occurs, when the disease, which has lain latent, makes rapid development. It has been found that wilted plants in a glasshouse may be saved by raising the average temperature to 77° F., and shading the glass lightly with whiting.

TOMATO-MILDEW (CLADOSPORIUM FULVUM).

This is the disease known here as tomato-mould or tomato-rust. It is a fungus that attacks the leaves, and in bad cases quickly spreads over the whole of the foliage and causes the death of the plants. It is essentially a glasshouse disease. The cause is insufficient ventilation, together with a high temperature and a saturated atmosphere. Dusting with dry sulphur and spraying with potassium sulphide have both been found useful, but the chief means of control is increased ventilation. Drastic measures must be taken ; after the first fruits are gathered the old leaves must be taken off up to the fourth joint and growths thinned out.

BLOSSOM-END ROT.

Of this trouble Dr. Bewley says it is universally found in tomato-growing areas. Plants that are growing rapidly are most susceptible, and either continued excessive watering or a sudden check in the water-supply may produce the disease. The latter condition appears to be the most common cause (this refers to England, where tomatoes are mostly grown in glasshouses), and careful attention to the conservation of the correct amount of water in the soil has generally been successful in preventing trouble.

"DAMPING OFF" AND "FOOT-ROT."

In the *Journal of the Ministry of Agriculture* for October, 1921, was published an informative article by Dr. Bewley on the control of "damping off" and "foot-rot" caused by *Phytophthora parasitica*, *P. cryptogia*, and *Rhizoctonia solani* in England. It is not certain whether all these diseases have been found in New Zealand, but rhizoctonia has certainly been identified at the Department's Biological Laboratory. Following is a summary of the article, published by the International Institute of Agriculture :—

Sterilization of soil, seed-boxes, and pots by means of heat or formaldehyde has previously been proposed as adequate methods for control of the serious diseases of tomatoes known as "damping off" and "foot-rot." These methods, however, do not suit many growers, and as a result another remedy has been put forward which has been named "Cheshunt Compound," investigations relative to this having been made at the Experimental and Research Station, Cheshunt.

This compound contains 2 oz. of copper sulphate and 11 oz. of ammonium carbonate, reduced to a fine powder and thoroughly mixed. The mixture may be stored in a dry state in an airtight receptacle, without which it gradually loses ammonia and becomes less potent. The dry mixture should be stored for twenty-four hours in a tightly corked glass or stone jar before using. The solution is then prepared by dissolving 1 oz. in a little hot water and making up to 2 gallons with water. The solution must not be put in vessels of iron, tin, or zinc, as it would corrode them and lose its strength. Only just as much as is required for immediate use should be prepared.

Plants already attacked receive no benefit from the solution and eventually die, unless the tops are cut off above the diseased part and treated as cuttings. It is possible, however, to kill the causal organism by watering infected soil with the solution, after which immediate planting may follow without harming the plants. It is possible also to treat infected soil with the plants *in situ*. The solution destroys the disease organisms and at the same time increases the vigour of the plants.

When the soil is suspected of being infected the following methods should be adopted :—

(*a.*) Seed-boxes : The soil should be thoroughly watered with the solution after sowing and covering the seeds. Generally 1 pint per box (14 in. by 9 in. by 2 in.) is sufficient.

(*b.*) Pots : The young seedlings should be planted and watered with the solution immediately afterwards. To enable each plant to get sufficient solution, the level of the soil should be 1 in. below the top of the pot. If left overnight before treatment many plants become infected and the treatment is rendered useless.

(*c.*) Houses : Each plant should be removed when attacked, the hole watered with 1 pint of the solution, a healthy plant inserted, and watering with the solution repeated.

This solution has a beneficial effect in the case of many seedlings attacked by "damping off" besides the tomato. In the case of delicate seedlings, however, it is necessary for the solution to be more diluted. Preliminary experiment with the compound upon other root-diseases has given satisfactory results.

It may be mentioned that the current price for ammonium carbonate from wholesale druggists in New Zealand is 1s. 3d. per pound for small quantities.

PREPARATION OF SOIL FOR DISEASE-CONTROL.

The *Australasian Nurseryman and Seedsman* for December, 1922, in an article referring to "spotted wilt" (a serious disease not known to be in New Zealand) and rhizoctonia, quotes Mr. Brittlebank, Plant Pathologist to the Victorian Government, who speaks of rhizoctonia as a most destructive disease that is widespread in Australia. He recommends special preparation of soil for seed-boxes as a means of control. The soil, he says, should be prepared fully a year before it is used, being mixed with lime and turned from time to time. The present writer may add to this that the soil should not be allowed to grow weeds. It should be turned often enough to prevent much growth, and the top hoed over now and again. Some growers raise their plants in glasshouses, in half benzine-tins. The soil for this purpose is prepared by growing green crops on a selected plot. Several crops are grown and turned in as they are ready, manure being given to ensure good growth and to enrich the soil. The soil is thus prepared during the summer and taken for use in autumn or early spring. It would be better if it were prepared a year before, keeping it stacked and clean as described. A season of clean fallow doubtless largely rids the soil of diseases ; for example, experiments have shown that one year's clean fallow does as much good against eelworm as the most successful chemical treatment. Some of our most experienced growers prepare their box soil a year and even more in advance, being fully aware of the value of clean material and the benefit it derives from full exposure to sun and air. Others stack their soil in good time, but neglect to keep weeds down, which latter is all-important.

Bottling of Cider.—In the article on cider-making published in the *Journal* for April last (page 249) it was inadvertently stated that the corks should be boiled before use. The correct practice is to steep the corks in warm water—not boil them.

DODDER IN WHITE CLOVER.

NEW MAGNETIC PROCESS OF REMOVAL.

NELSON R. FOY, Seed Analyst, Biological Laboratory, Wellington.

In the report of the English official seed-testing station for 1922–23 the following statement is made regarding white clover: "New Zealand seed shows the highest purity and germination. It is unfortunate, however, that more attention is not paid to the removal of the small-seeded dodder."

While the sale of white clover containing dodder is not prohibited in England, the dodder-content of such seed has to be declared if the seed is offered for sale. The presence of dodder must therefore greatly depress the price. In some other countries to which New Zealand exports white-clover seed the import regulations are not so lenient; Australia will not allow the entry of a line even if it contains only one seed of dodder per pound—it must be "dodder-free." The United States allows only one seed in 5 grams, which is at the rate of approximately ninety seeds per pound. In Canada the Seed Control Act operates in a similar manner to that of England.

It is evident, therefore, that for an overseas trade to be successfully carried on New Zealand white-clover seed must be free from dodder. According to the purity examination made at our station only 5 per cent. of the samples examined contained dodder. It must be borne in mind, however, that a 1 oz. or 2 oz. sample will not always reveal the presence of dodder in a large line. Recently two 1 oz. samples of a line were passed as dodder-free, but a later examination of an 8 oz. sample revealed the presence of dodder. Further, only a portion of the white-clover samples received are analysed for purity, and a large number of samples which are tested for germination only will probably contain dodder.

Small-seeded dodder (*Cuscuta trifolii*) in white clover has always given the seed-cleaner trouble, as its size prevents it being totally dressed out. In cow-grass its removal presents no difficulty. In white clover a great deal is removed by means of screens and the velvet linings of the Dosser machine, but there always remain the few seeds in sufficient quantity to give trouble. The introduction of a new electro-magnetic process for dodder-extraction is therefore of interest and importance. The method, like that of the Dosser machine, is based on the fact that dodder possesses a much rougher and less polished seed-coat than does the white clover. The seed is mixed with a powder which is sensitive to a magnet, and more of this powder adheres to the rough surface of the dodder-seeds than to the smooth coat of the clover. The seed is then passed under a magnet, which draws out the seeds bearing sufficient of the powder to be magnetically attracted. By this means the dodder may be absolutely eliminated, and, in addition, such seeds as rough-coated sorrel and broken clover-seeds whose rough surfaces hold the powder would be removed. After the magnetic treatment the clover is passed through a polisher to remove any adhering powder.

Mr. C. B. Saunders, late chief officer of the English seed-testing station, stated recently in the *Journal of the Ministry of Agriculture*: "The first commercial machine working on the principle outlined has been in use for six months, and has given remarkably good results, a single treatment removing every seed of dodder from a bulk of Chilian red clover. Apart from its efficiency for removing dodder the importance of the process lies in the very small wastage. The machine has dealt with over 50 tons of seed, and the total cleanings are not much more than half a ton, so that it follows that the amount of good seed removed is negligible."

Such a machine should amply pay for itself in New Zealand, as it would enable the removal of all dodder from any clover or Lotus seed. Further particulars can be given by the writer to any of those specially interested.

TESTING OF PUREBRED DAIRY COWS.

JANUARY–JUNE CERTIFICATE-OF-RECORD LIST.

W. M. SINGLETON, Director of the Dairy Division.

THE appended list of cows which received certificates during the six months ended 30th June, 1924, comprises more names than that for any similar period since the C.O.R. testing system was initiated. This naturally is accounted for to some extent by the general increase in the total number of cows under C.O.R. test, but more particularly by the fact that, as time goes on, breeders seem to adhere less strictly to the common practice of having cows freshen in the spring. There are many dairymen who are of the opinion that it is advantageous to have their cows calve in the autumn. They maintain that autumn calvers coming in in good condition after a rest during the late summer are better able to stand the winter. They get the benefit of the spring just when the body begins to feel the effects of renewed pregnancy, and thus a falling-off in milk-flow is postponed. Thus, while the spring still brings its rush, the C.O.R. testing is each year becoming more evenly distributed throughout the twelve months. Concerning this point the following figures are of interest:—

Month.	Number of Cows on Test.	Month.	Number of Cows on Test.
1923.		1924.	
July	925	January	1,164
August	970	February	1,165
September	1,089	March	1,161
October	1,163	April	1,129
November	1,185	May	1,107
December	1,173	June	1,037

From this table, presenting the number of cows on test month by month during the past year, it will be seen that while November shows the flush, the other months do not indicate the falling-off which might be expected.

NOTES ON THE LEADING RECORDS.

Jerseys.

The highest Jersey performance is that of Grafton Marigold, tested by Messrs. Brakenridge and Pearson, of Taupaki. This mature cow produced 734·23 lb. of butterfat, which for her owners should be an encouraging result of a first season's experience of C.O.R. testing. Her pedigree contains the names of many proven animals, and also strains which, though perhaps not proven through test of the individual itself, are nevertheless recognized through the performances of progeny. The grandsire on the sire's side is Golden Swan. On the same half of the pedigree appear such names as K.C.B. and some of the Sunflowers. The dam of Grafton Marigold is Pepper's Girl, a daughter of Pepper (546·01 butterfat at 3 years 195 days in the first year of the C.O.R. system). K.C.B. also appears on this side of the pedigree. It is therefore a more or less reasonable expectation that Grafton Marigold should yield creditably.

Friesians.

The outstanding butterfat yield for this breed is credited to Mr. James Hart's Lady Pauline, who has gained a certificate on a production of 850·66 lb. butterfat. This cow has previously figured in our records, when as a junior two-year-old she qualified on the yield of 603·85 lb. butterfat. She is sired by Prince Pietertje of Cliffside, who is also the sire of Princess Gem (794·84 lb. butterfat), and of Lady Fayne, who produced 498·66 lb. butterfat as a senior two-year-old. Prince Pietertje of Cliffside is in turn sired by Cliffside Laddie, whose name requires no comment. Lady Pauline's dam is the imported Johanna Fayne Lady, who has gained two certificates of record in New Zealand—one for 325·95 lb. and another for 532·38 lb. butterfat, each at an age under maturity.

Milking Shorthorns.

Matangi Quality 4th, owned by Messrs. Ranstead Bros., heads the section for the Milking Shorthorns. She is a junior three-year-old and has placed 678·02 lb. butterfat to her credit, thus exceeding the record of the previous leader of this class—Dominion Carnation of Ruakura—by no less than 238·82 lb. Matangi Quality 4th is a daughter of Dominion Esau of Ruakura. It is interesting to note that of the seven classes into which the Milking Shorthorn breed is subdivided five of the class-leaderships are held by animals owned by Messrs. Ranstead Bros., and that each leader, with the exception of Maniaroa Princess, the mature-class champion, is a daughter of Dominion Esau of Ruakura.

Ayrshires.

Only two Ayrshires appear in the list, but Mr. E. J. Irving's Queen Mary has produced very creditably with 573·65 lb. butterfat. She is by Lessnessock Grandeur from Sunbeam 2nd of Inglewood.

LIST OF RECORDS, JANUARY TO JUNE, 1924, INCLUSIVE.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Violona	Farrow Bros., Waitoa ..	1 302	240·5	326	10,435·2	575·90
Waionui Flirt ..	W. H. Miers, Rukuhia ..	2 87	249·2	365	9,245·7	548·88
Clever Mary ..	J. Perham, Waipuku ..	1 303	240·5	365	8,362·2	468·36
Tillingdown Constance	Dr. H. Washbourne, Richmond	2 34	243·9	365	7,915·7	468·30
Hopeful Choice ..	W. T. Williams, Pukehou ..	2 85	249·0	365	7,608·5	459·05
Grafton Mint ..	A. A. White, Auckland ..	2 29	243·4	365	8,586·0	427·65
Alfalfa Senora ..	F. J. Saxby, Hamilton ..	1 211	240·5	365	7,394·8	425·47
Snowview's Lenora ..	A. E. Watkin, Takanini ..	1 307	240·5	305	6,783·8	411·82
Pet Irene†	C. Stevens, Maungatapere ..	2 39	244·4	365	7,514·4	408·38
Illawarra Beautiful ..	E. G. Jones, Midhirst ..	1 229	240·5	365	6,303·0	376·05
Jerseydale Fairy ..	J. Pettigrew, Pihama ..	2 23	242·8	365	7,142·5	369·72
Marama Glory ..	R. S. Coplestone, Eltham ..	1 361	240·5	365	7,736·6	369·55
Corra Lynn Rosebud	A. Best, Bombay ..	2 31	243·6	365	6,928·6	367·61
Silverley's Autumn Rose	R. C. Jury, Tikorangi ..	1 261	240·5	365	5,791·5	349·77
Ratanui Magnet ..	R. S. Coplestone, Eltham ..	2 50	245·5	334	7,447·7	349·62
Loo's Majesty ..	A. Christie, Tanekaha ..	1 303	240·5	212	6,057·2	329·35
Creekton Lady Koura	C. Brock, Eltham ..	1 354	240·5	245	5,284·9	301·75
Bridge View Myrtle ..	A. L. Hooper, Mahoe ..	2 27	243·2	198	4,523·1	259·35
Wee Lark	R. Hicks, Hawera ..	2 34	243·9	181	5,496·2	257·02
Senior Two-year-old.						
Ratanui Marionette ..	W. T. Williams, Pukehou ..	2 107	251·2	365	12,659·7	588·72
Hurden Goldfish ..	G. E. Cowling, Manaia ..	2 137	254·2	365	6,521·7	385·40
Trewithen's Sylvia ..	J. Klenner, Kaimata ..	2 355	276·0	327	6,530·7	383·54
Signor's Whitefoot ..	G. Buchanan, Paeroa ..	2 204	260·9	332	5,760·0	326·00
Pretty Sweetheart ..	H. C. Sampson, Hillsborough	2 221	262·6	334	4,621·0	263·94
Three-year-old.						
Viola's Frisky ..	A. L. Hooper, Mahoe ..	3 79	284·9	365	10,502·8	646·14
Holly Oak's Tiny ..	Dr. H. P. Pickerill, Kelso ..	3 66	283·6	365	9,536·8	545·10
Pettie's Charm ..	R. S. Coplestone, Eltham ..	3 253	302·5	364	8,098·2	512·47
Princess Eleanor ..	R. J. W. Hancock, Waitara	3 283	305·3	310	8,498·2	480·43
Jersey Brae's Oaks ..	F. J. B. Ryburn, Paterangi	3 333	310·3	282	8,903·6	442·01
Bridge View Tiny ..	G. A. Gamman, Marton ..	3 268	303·8	295	7,932·5	441·17
Four-year-old.						
Heywood's Ethel† ..	J. McIvor, Ohaupo ..	4 335	347·0	306	9,866·1	581·61
Royal Jenney's Lady	T. H. Verry, Pahiatua ..	4 54	318·9	365	10,062·7	570·36
Kathleen Mahone ..	H. Doel, Taumarere ..	4 137	327·2	365	8,339·9	482·36
Riverina Peep Bo ..	H. W. Nicholls, Belgrove ..	4 88	322·3	365	9,466·3	462·14
Climax	W. McGowan, Papatoetoe ..	4 193	332·8	344	7,111·3	357·11
Mature.						
Crafton Marigold ..	Brakenridge and Pearson, Taupaki	6 257	350·0	365	13,626·0	734·23
Agatha	C. Stevens, Maungatapere ..	9 23	350·0	365	12,421·7	655·84
Cream of O.K. ..	T. Linn, Mangatoki ..	6 327	350·0	365	11,257·5	649·36
Beachland's Marguerite	Moreland and Son, Te Rapa	5 40	350·0	365	10,674·9	599·69
Briar Chase ..	W. J. Hall, Matatoki ..	5 75	350·0	365	10,207·9	586·77
Mountain View's Sunflower	W. J. Hall, Matatoki ..	7 191	350·0	365	10,453·5	563·45
Linnett	C. G. C. Dermer, Waipiko ..	11 127	350·0	365	13,041·2	530·82

WAIPIKO JOLLY (C. G. C. DERMER, WAIPIKO).

C.O.R., 1923, in Jersey junior two-year-old class: 11,512·9 lb. milk, 610·40 lb. butterfat.

ASHLYN BEATUS (PIRI LAND COMPANY, AUCKLAND).

C.O.R., 1923, in Friesian mature class: 15,359·7 lb. milk, 751·79 lb. butterfat.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued.*						
Mature—continued.		Yrs. dys.	lb.		lb.	lb.
Collingwood Ruby ..	Hellyer Estate, Dunedin ..	6 134	350·0	365	9,572·9	515·39
Katie of St. Lambert's Queen	H. B. Lepper, Lepperton ..	9 4	350·0	365	9,437·2	513·75
Silverdale Primrose ..	G. Hodgson, Whakapara ..	5 79	350·0	365	8,139·1	482·15
Antelope	K. M. Stevens, Maungatapere	8 6	350·0	365	10,045·5	477·07
Paratawhiti Prim ..	G. E. Cowling, Manaia ..	7 286	350·0	360	9,301·0	476·64
Pride of Tumanako ..	G. A. Gamman, Marton ..	6 105	350·0	355	9,559·2	470·62
Sweet Mabel of O.K.	R. Dunn, Auroa	7 27	350·0	240	7,807·1	467·11
Darkie of Ascot ..	Miss Y. Southey-Baker, Te Rapa	5 236	350·0	365	8,096·6	464·65
Calabria	C. Stevens, Maungatapere ..	6 32	350·0	365	8,262·5	450·32
Cruiskeen†	C. Stevens, Maungatapere ..	6 120	350·0	365	7,641·2	415·57
Belmont Jersey ..	C. B. Herrold, Waiuku ..	5 323	350·0	359	6,425·3	414·31
Flower of Collingwood	Hellyer Estate, Dunedin ..	7 263	350·0	296	9,025·8	403·84
FRIESIANS.						
Junior Two-year-old.						
Springtime of Oakview 3rd*	H. R. Green, Kairanga ..	2 37	244·2	365	17,192·4	652·61
Glenmore Tilly Alcartra*	Henry Johnston, Stratford	2 27	243·2	365	14,595·5	495·05
Skylark Alcartra† ..	S. Andrew, Kaikoura ..	2 92	249·7	365	14,899·5	470·63
Netherland Princess Lady*	W. I. Lovelock, Palmerston North	2 31	243·6	365	12,219·5	399·46
Welfare Alcartra† ..	S. Andrew, Kaikoura ..	2 30	243·5	365	10,986·2	388·44
Anawhata Tirania De Kol†	P. F. Boucher, Kumeu ..	2 146	255·1	365	10,365·0	365·03
Zealous Alcartra† ..	S. Andrew, Kaikoura ..	2 17	242·2	365	10,011·8	364·17
Dale Ida*	R. C. Allen, Piako ..	2 25	243·6	355	9,735·5	359·68
Friesian Cadilac Princess*	W. I. Lovelock, Palmerston North	2 43	244·8	310	9,464·1	347·38
Playgoer Alcartra† ..	S. Andrew, Kaikoura ..	1 347	240·5	365	9,423·5	320·91
Senior Two-year-old.						
Cordyline Daisy Bud†	G. Aitchison, Kaitangata ..	2 187	259·2	364	11,575·0	470·47
Ashlynn 86th† ..	Piri Land Company, Taupiri	2 298	270·3	342	10,873·6	385·13
Ashlynn 89th† ..	Piri Land Company, Taupiri	2 282	268·7	329	12,109·4	382·40
Junior Three-year-old.						
Abbe Queen Segis* ..	J. McAnulty, Ashburton ..	3 101	287·1	365	15,996·6	573·13
Bloomfield Netherland May*	Bloomfield Farm Company, Wellington	3 48	281·8	365	13,157·8	553·33
Isabella Abbekerk 2nd†	Voss Bros., Longburn ..	3 87	285·7	365	12,085·3	468·72
Ryvington Thora† ..	Hodgson Estate, Tamahere	3 117	288·7	365	11,397·2	445·19
Cordyline Canary De Kol†	G. Aitchison, Kaitangata ..	3 182	295·2	348	11,376·5	436·53
Senior Three-year-old.						
Galatea Queen* ..	C. W. Baldwin and Son, Ngatoro	3 270	304·0	308	15,971·5	524·00
Countess Belle Segis†	P. F. Boucher, Kumeu ..	3 314	308·4	362	10,520·4	382·43
Cluny Annette 7th† ..	W. H. Madill, Auckland ..	3 192	296·2	329	9,837·4	357·82
Junior Four-year-old.						
Ryvington Quick† ..	Hodgson Estate, Tamahere	4 101	323·6	365	14,529·8	626·08
Princess Pontiac De Kol†	A. Burgess, Rongotea ..	4 64	319·9	365	16,269·8	529·74

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS—*continued.*						
Mature.		Yrs. dys.	lb.		lb.	lb.
Lady Pauline* ..	J. Hart, Tatuanui, Thames	7 234	350·0	365	25,306·2	850·66
Emily Mercedes Grant*	Bloomfield Farm Company, Wellington	10 262	350·0	365	19,206·3	631·16
Lillith Mercedes of Hawkridge*	R. Colee, Greendale ..	5 61	350·0	365	18,077·8	543·55
Laddie's Pearl† ..	N. P. Neilson, Tiakitahuna	12 49	350·0	365	14,066·8	410·97
MILKING SHORTHORNS.						
Junior Three-year-old.						
Matangi Quality IV†	Ranstead Bros., Matangi ..	3 153	292·3	365	16,281·4	678·02
Mature.						
Otaua Peggy† ..	S. Lye, Newstead ..	..	350·0	354	12,485·4	470·16
Duchess of Clydesdale 2nd	Robert Peach, Ashley Bank	7 346	350·0	353	10,605·3	425·78
Daisy 4th	Robert Peach, Ashley Bank	7 57	350·0	335	10,246·9	368·60
AYRSHIRES.						
Mature.						
Queen Mary* ..	E. J. Irving, Ryal Bush ..	5 347	350·0	365	14,760·0	573·65
Wee Nancy of Edendale	W. Hall, Lepperton ..	12 109	350·0	365	11,452·8	467·22
SECOND-CLASS CERTIFICATES.						
JERSEYS.						
Junior Two-year-old.						
Waionui Fortunate ..	A. J. Dempsey, Horsham Downs	2 66	247·1	365	8,174·3	475·07
Adare Sunbeam ..	J. A. Kurth and Son, New Plymouth	1 219	240·5	365	6,789·2	412·33
Grafton Pepper ..	A. A. White, Auckland ..	1 286	240·5	365	8,168·5	390·32
Senior Two-year-old.						
Regal Patritia ..	C. Stevens, Maungatapere ..	2 135	254·0	365	7,058·7	383·47
Three-year-old.						
Rainbow's Interlude..	H. George, Kaupokonui ..	3 303	307·3	365	7,581·9	465·56
Mature.						
Twylish's Darkie ..	F. J. Saxby, Hamilton ..	5 364	350·0	365	13,193·4	808·78
Lucky Dorothy Cactus	C. Stevens, Maungatapere ..	5 94	350·0	365	12,110·3	653·70
Lady Briar.. ..	H. C. Sampson, Hillsborough	8 78	350·0	365	10,081·8	569·52
FRIESIANS.						
Junior Two-year-old.						
Brookfield Nobeltje Pride	Piri Land Company, Taupiri	1 323	240·5	365	13,068·0	477·39
Pakeha Alcartra ..	S. Andrew, Kaikoura ..	1 331	240·5	365	12,077·7	411·49
Junior Four-year-old.						
Rosevale Isobel ..	North and Sons, Omimi ..	4 119	325·4	365	20,122·6	643·11
Mature.						
Riverdale Cherry Blossom	S. Clements, Rototuna ..	7 44	350·0	365	13,031·9	461·82
Cordyline Cherry Ripe	R. J. Potter, Pukerau ..	6 190	350·0	195	10,206·9	363·54

SEASONAL NOTES.

THE FARM.

CARE OF PASTURES.

AUGUST often brings quite an appreciable amount of pasture-growth, at any rate in the milder districts, and where roots and other winter fodder are running short this early bite is very welcome. The stock, too, will at this time of year relish the slenderest picking of fresh grass, and in these circumstances it is always a temptation to allow them to feed closely all they can find. Crops of a purely temporary nature, such as Western Wolths or Italian rye-grass, green oats, &c., can be so treated, while an old turf carrying a certain amount of rough feed is often benefited; but young permanent grass, and even old grass where it has a tendency to become bare at the roots, may suffer considerably at this time by the overgrazing and poaching of stock. The farmer who can save his permanent grass by utilizing catch-crops, or by feeding out mangolds or ensilage on dry, well-turfed paddocks, will reap the benefit later in the season.

Top-dressing of pastures should be completed in August. In the wetter districts slag may be put on up to the middle of the month, but in drier regions and on light soils spring manuring should consist mainly of super or basic super, at the rate of about 2 cwt. per acre. It is often a good plan to leave one or two untreated strips across the paddock. Observation of the grazing of stock and the growth of the grasses may lead to some special ideas being gained of the value of top-dressing on the respective area. Occupiers of land with a tendency to revert to fern will find that stock graze much more keenly where phosphatic fertilizers have been used, the manure-bag thus being an excellent weapon against such secondary growth as well as against the smaller weeds. The harrows should be kept going to distribute the droppings of stock.

SPRING CULTIVATION.

August being the beginning of the busy season in cultural operations, the team should be kept going when weather and soil conditions permit, but on no account should attempts be made to work land while in a waterlogged condition. Generally speaking, this refers to land previously ploughed during late autumn or winter which has absorbed and retained the seasonal rains. On the other hand, grassland may be ploughed a first time while fairly moist. In the drier districts, such as North Otago, Canterbury, and Marlborough, deep ploughing of land in preparation for spring-sown crops should, as a rule, not be undertaken after August, otherwise the operation will result in a loosening of the soil to too great a depth and consequent undue loss of moisture.

Land intended for roots or green fodders, main-crop potatoes, &c., should be taken in hand and kept stirred occasionally from now on till sowing-time, with the object of germinating and killing as

many weed-seeds as possible. The great object should be to have a fine mellow, well-aerated seed-bed. Lea land previously skim-ploughed should be cross-ploughed as soon as dry enough, in order that a reasonable fallow may result.

CEREAL CROPS FOR GRAIN OR CHAFF.

Weather permitting, spring wheat, oats, and barley should be got in during August in Canterbury, North Otago, and Marlborough. In South Otago, Southland, and the North Island early September is generally soon enough for oats and wheat, and towards the end of that month for barley. Seed should be treated for smut with formalin or bluestone solution according to details given in these notes in the *Journal* for April last. Heavier seeding is necessary for spring-sown wheat—say, from 2½ to 2¾ bushels per acre, while 1 cwt. to 1½ cwt. of super is advisable. One or more of the quick-maturing and hardy varieties should be chosen. With oats, especially when required only for chaff, the preference lies with Algerian as the most rust-resistant variety.

Autumn-sown cereal crops should be harrowed in order to break any crust which may have been caused by winter rains. The resulting soil-mulch will dry quickly and leave the surface in loose condition such as to prevent the moisture rising from below reaching the surface and so being lost by evaporation. Where the ground is lumpy a rolling will break down the clods and pack the lower soil more thoroughly. Such rolling should always be followed by a stroke of the harrows. If the crop has not been previously manured and appears thin or weak 1 cwt. of super per acre, either before or after harrowing, will be beneficial. A little cow-grass—say, 3 lb. or 4 lb. per acre—sown on the crop at this time should prove profitable, providing a fresh bite for stock after harvest while the stubbles are being cleaned up, and later to be ploughed in.

Feeding off of autumn-sown cereals should be done before the crops become too rank, and, generally, two light feedings will be better for the crop and the stock than one heavy feeding. If the land is inclined to be still wet, stock should be kept off, or excessive caking of the ground will result.

The practice of spring sowing a pasture mixture on autumn-sown cereals is much in favour in some South Island localities. If the cereal crop has not already been manured a dressing of about 1 cwt. per acre of super or basic super or Ephos phosphate will generally be an advantage.

LUCERNE AND CLOVER STANDS FOR SEED.

August is a good month for the cultivation of lucerne and red-clover stands intended for seed. The tine harrows or a cultivator with special lucerne points are generally used. The disks, moderately used with a straight cut, often prove beneficial to a stand which has been established for two years or longer. The yield of seed from both red-clover and lucerne stands will normally be much increased by top-dressing with one or other of the following manurial mixtures: (1) 1 cwt. super, following 1 ton lime per acre; (2) ½ cwt. super and ½ cwt. rock phosphate per acre; (3) ½ cwt. super, ¼ cwt. blood-and-bone, and ¼ cwt. rock phosphate per acre.

—*Fields Division.*

THE ORCHARD.

SPRAYING.

THE most important work for the fruitgrower during the next few months will be spraying. It is now generally recognized that spraying, if it is to give the maximum amount of efficiency, must be carried out at the right time. It is necessary to make a study of the local conditions and to keep a record of the various applications, so that the grower can determine the best times. A great deal of time and material is often wasted by spraying for insect pests during June or early in July. It has been proved that for certain insect pests this is of very little value, and that by deferring the work until a later date much better results will be obtained.

Stone-fruits will be the first to receive attention, as soon as the buds begin to swell. The next in order for treatment will be the pip-fruits, about the last week in August, for the control of red-mite, woolly aphis, and all scale insects, also pear-blister mite on pear-trees. Following these it will be necessary to consider how best to prevent the ravages of black-spot on apples and pears. The following spraying-calendar will serve as a guide during the next two months :—

Fruit.	Pest or Disease.	Spray.	Time of Application.
		Stone-fruits.	
Peaches ..	Leaf-curl	Bordeaux mixture, 8–6–40 (8 lb. sulphate of copper, 6 lb. fresh burnt lime, and 40 gallons water)	When buds are swelling.
Nectarines	,, ...		
Plums ..	Bladder-plum ..		About middle to end of August.
Apricots ..	Shot-hole fungus ..		
Cherries ..	,, ..		
		Pip-fruits.	
Apples ..	Red-mite and scales	Red oil, 1–12 ..	End of August.
Pears ..	Pear-blister mite ..	,, 1–12 ..	,,
Apples ..	Black-spot ..	Lime-sulphur, 1–10 ..	At green-tip.
,, ..	,, ..	,, 1–40 ..	When buds show pink.
,, ..	,, ..	Lime-sulphur, 1–100 to 125; arsenate of lead, 3 lb. paste or 1½ lb. powder	At petal-fall.
Pears ..	,, ..	Bordeaux, 5–4–40 ..	At tight cluster.
,, ..	,, ..	,, 4–4–40 ..	At pink.
,, ..	,, ..	,, 3–4–40 ..	At petal-fall.

Where varieties of apples are very susceptible to black-spot, and only on those varieties not subject to much russeting, it may be advisable to substitute bordeaux 3–4–50 when buds are showing pink. The last-named applications on apples and pears will need to be repeated throughout the season at intervals of from fourteen days to a month, according to weather conditions and also the amount of disease threatening. Arsenate of lead can be used in conjunction with them for the control of all chewing-insects such as codlin-moth, leaf-roller caterpillar, and bronze beetle, using 3 lb. paste or 1½ lb. powder to every 100 gallons water.

MANURING.

An important point often lost sight of is the manuring of the trees. This accounts in large measure for the poor returns so common from many orchards. It is quite impossible to obtain from fruit-trees adequate returns if sufficient plant-food is not available to build up a good healthy tree. Lack of plant-food means a weak tree, which is more liable to be attacked with disease than trees that are strong and vigorous. Moreover, it is mainly through lack of vigour in the tree that so much injury is caused in the spraying operations.

Soil that is lacking in organic matter should receive a liberal dressing of farmyard manure if obtainable. Failing this, if a good cover-crop has been ploughed under, the trees should be given a good dressing of artificial manure. A complete orchard-manure is made up of the following: Superphosphate, 3 parts; sulphate of potash, 1 part; and nitrate of soda (or sulphate of ammonia), 1 part. These can be combined and, if necessary, applied in one dressing; but the better plan is to mix the superphosphate and sulphate of potash together and apply it at the rate of from 2 lb. to 10 lb. per tree, according to the nature of the soil and the age of the tree. The nitrate can be applied by itself and used only on the trees which are not making satisfactory wood-growth, as it is not necessary on the strong and vigorous trees.

PLANTING.

If intended planting has not already been done it will be necessary to push along with the work when the land is in a suitable condition. All trees should be cut hard back at time of planting, thus enabling the roots and top to commence growth on equal terms.

—L. Paynter, Orchard Instructor, Christchurch.

CITRUS-CULTURE.

The harvesting of the orange crop—both Poorman and the earlier-ripening sweet varieties—is the most important work to be carried out during the coming month. It is noticed that citrus brown-rot is very prevalent in a number of orange-groves this season. This is mainly caused by damp conditions often brought about by trees being allowed to grow too densely, and the bottommost branches being allowed to sweep the ground, thus preventing a free current of air. It is most essential that immediately upon identification all diseased fruit should be removed and destroyed. The usual course of treatment for the prevention of this disease should then be carried out in the early spring, in the form of an application of pulverized sulphate of iron, 2 lb. to 3 lb. per tree, forked into the feeding-roots.

The pruning of citrus-trees, where such is required, may now be commenced. The two main features should be the thinning-out of the centres of the trees where too many branches have been allowed to grow, and removal of branches that are crossing one another. Clean cuts should be made in each case, either to an existing lateral or an active bud, it being necessary to refrain from leaving snags which will die back and allow of the entry of boring-insects.

FIREBLIGHT.

That area of commercial orchards which was unfortunate enough to be visited by fireblight during last spring is being reinspected at the

time of writing, for the purpose of identifying any existing hold-over cankers. Nevertheless it behoves all orchardists who are growers of pip-fruits to maintain vigilance throughout the pruning season, with a view to assisting in this direction. It is as well to remember that one active hold-over canker may be sufficient to cause the infection of a wide area of apples or pears. The attention of orchardists and other occupiers of land upon which common white-blossoming hawthorn (*Crataegus oxycantha*) is growing is directed to the following clauses of the regulations under the Fireblight Act, 1922:—

2. In the case of those districts and parts of districts included in the Second Schedule, all hawthorn shall, between the 1st day of June, 1923, and the 31st day of July, 1923, be cut down so as to prevent any part thereof from flowering, and thereafter shall be similarly cut down in the month of June or July in each year and at such other times as may be necessary to prevent any part thereof from flowering.

3. In the case of the district and parts of districts included in the Third Schedule, wherein fireblight is known to exist, all hawthorn growing therein shall be completely destroyed before the 30th day of June, 1923, and any plants which may appear subsequently shall forthwith be completely destroyed.

—*J. W. Collard, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

HATCHING AND REARING.

AUGUST and September generally share as being the best months of the year for hatching out chickens for the renewal of stock. It should therefore be the aim of all poultry-keepers to secure the required number of young birds before the end of September. If chickens are to develop into really profitable stock it is imperative that they be well over the brooder stage before the hot summer weather sets in. The production of late-hatched stock is the weak link on many unsuccessful plants. There are no chickens that do so well as those which develop as the days are lengthening, rather than when they are on the wane.

In regard to the work of rearing young stock, I cannot urge too strongly the necessity of providing the little birds with clean quarters and clean runs. The plant should be arranged in such a way that when the chickens are drafted from the brooder they can be provided with a clean run—preferably one which has been sown down with rape, grass, or other suitable green material. It should be remembered that chickens will develop better on a small piece of clean ground than a large area of tainted soil. In the case of late-hatched stock, a special effort should be made to place the birds on fresh ground. On most plants it will be found that the late birds make poor growth. The common cause of this is that they have to follow stock hatched earlier in the season, and are compelled to run on stale and tainted ground.

The Natural Mother.

In setting a hen the best plan is to make the nest on the ground, and if a box is used the bottom should be taken out of it. The nest shou'd be slightly hollowed out in the centre or saucer-shaped. The hen should be tested with a few china eggs until it is shown that she

will sit steadily and can be entrusted with the eggs intended for hatching. These should be placed in the nest in the evening, and much annoyance and trouble may be avoided if this precaution is taken. Do not neglect to see that the hen is free from vermin. Many fowls leave their eggs just when they are on the point of hatching, because they are being pestered beyond endurance by lice. Before the hen is set she should be dusted with insect-powder. A dust bath should also be provided, so that she can free herself of vermin in nature's way. Care must also be taken that the coop is free from red-mite; a good spraying with strong disinfectant or kerosene will ensure this.

The food for sitting-hens should consist of whole grains, maize being included when available. This, with grit and clean water, is all that is required. Mashes, meat, and green food are apt to slacken the bowels and cause the eggs to be soiled, to the detriment of the hatch.

When the eggs commence to hatch do not interfere with the hen; she can manage best by herself. It is only courting trouble to take the chicks out of the nest as they hatch; they should be left to the care of the hen. Chicks do not require food for at least a day after hatching. The coop in which the hen and her brood are placed should be arranged in such a way that the chicks may be kept off wet ground. Care should also be taken that when the chicks leave the nest they can return to it again with ease; many are lost through getting out of the nest and being unable to get back to it. Many also are drowned by jumping into deep water-vessels; this risk should be minimized by using a shallow water-tray.

CHICKEN-POX.

Many complaints have reached me of late regarding outbreaks of chicken-pox. These have been confined to the North Island; this disease is rarely seen in the South Island.

The trouble usually first manifests itself by yellow-crusted nodules of various sizes on the comb and wattles. The disease is highly contagious; therefore as soon as it makes its appearance the affected birds should be isolated and the quarters thoroughly cleaned and disinfected. The next measure is to get the birds' blood in good order, not only in the case of the diseased birds but all others in the flock. For this purpose frequent doses of Epsom salts and sulphur should be given—about 1 oz. of the salts for every twelve birds, dissolved in the water with which the mash is mixed, and a similar quantity of sulphur thoroughly mixed with the dry ingredients of the mash before adding the water. In districts where fowls are subject to this disease periodical doses of salts and sulphur, as directed, will tend greatly towards rendering the birds immune from the trouble. Another important point is to see that the flock are liberally provided with succulent green material. The diseased parts on affected birds should be dressed daily with carbolized vaseline. Indeed, as a means of preventing the disease from spreading, it is a good plan to frequently give a light application of vaseline to the combs and wattles of all birds in the flock. After treating a diseased bird care must be taken that one's hands are well disinfected before handling fowls that are free from the disease.

Sometimes chicken-pox is accompanied by diphtheric roup. This takes the form of cheesy matter collecting about the mouth and windpipe, while the breath usually becomes foul. When these two diseases go together and have gained a good foothold there is no telling when the trouble will be stamped out. In bad cases it is better to kill the bird and burn the carcase, as one bad attack renders the victim susceptible to further attacks. In addition to the treatment already stated, and as a cure, the following is recommended: Take a shallow dish or similar receptacle, fill it with pure kerosene, and dip the bird's beak in this sufficiently deep to just cover the nostrils. Hold the bird in this position until it breathes: this will have the effect of drawing the kerosene to the seat of the trouble. Repeat the treatment on alternate days until a cure is effected. Another remedy is to place, say, one or two small Condy's crystals on the end of the finger, and, after moistening them, work them round deep down in the bird's mouth until dissolved. This will cause a discoloration of the bird's mouth and also the finger, which will have a harmless effect on the latter but a beneficial one on the former. The diseased spots in the mouth and throat may also be treated with powdered bluestone, slightly moistened. This may be applied with a fine camel-hair brush or with a feather.

As with most troubles affecting poultry, the only safe policy with chicken-pox is to prevent it. The first essential in this respect is to keep the quarters clean, and by good feeding and proper management maintain the flock in a healthy state, so that the birds may have the power to resist infection should they come in contact with it.

F. C. Brown, Chief Poultry Instructor.

THE APIARY.

PREPARATIONS FOR THE NEW SEASON.

DURING the dormant season every spare moment should be spent in making preparations for next season's work. All defective supers, roofs, and bottom-boards should be overhauled and, where necessary, given a good coat of paint. This work, if delayed, is apt to interfere with the main work in the apiary when the bees are calling for special attention, and should not be postponed.

If it is desired to increase the apiary, hive and frame making should be pushed on, and ample provision made for increase before the actual time arrives for putting preconceived plans into operation. Where the beekeeper does not make his own hives he should now order sufficient stocks to see him through the season. In the majority of cases it does not pay the beekeeper to make his appliances. Hive-manufacturing in the Dominion has been brought to a high standard, and unless the apiarist has ample capital to purchase machinery to turn out good hives he will find the home-made article too costly in the long-run. Whether the beekeeper is working on a small or large scale he should aim at uniformity, and in building up an apiary decide at the beginning on the style of hive and frame he is going to use, and continue on those lines. Non-fitting supers and frames mean extra labour, and lead to endless trouble. In the past, manufacturers have been greatly to blame

for continually altering the type of hive placed on the market, and consequently beekeepers have found great difficulty in keeping appliances uniform. As yet no regular type of hive has been adopted for the Dominion, but the dovetailed hive now so popular among beekeepers is easily the best offered by the suppliers. The sizes in use are mostly ten- and twelve-frame, and experience of his district will enable the beekeeper to decide as to the best one to adopt.

To meet those cases where cost is a consideration a durable frame hive can be made out of a petrol-case, which will comply with the provisions of the Apiaries Act. Petrol-cases are obtainable for a few pence, and can be readily converted by any one handy with tools. A kerosene-case may also be used, but it will be found necessary to reinforce it, so that the petrol-case is the handier. Particulars of a cheap home-made hive are given in Bulletin No. 55, "Bee-culture."

Overhauling the hives: As advised last month, all supers should be removed and the bees confined to the brood-chamber. This will keep the bees snug and promote brood-rearing, and at the same time facilitate the work of giving the hives their first spring overhaul. During the course of the winter there is usually an accumulation of pollen, dead bees, &c., on the bottom-boards, and consequently the latter require cleansing. All operations at this period should be carried out quickly as a safeguard against robbing. To cleanse the bottom-board bring into use a spare one. Set the hive temporarily on the spare board while scraping and cleansing the permanent one, then replace the hive on its permanent stand. See that the hives have a slight cant towards the entrance. This will prevent moisture settling on the bottom-board, which is apt to cause the death of a considerable number of bees, besides making the hive damp and unwholesome.

Containers for export: A mistake often made by beekeepers who prepare bulk honey for export is to leave the preparation of their containers until the honey is extracted. Supplies of tins should be obtained in the off-season, when more time and care can be spent in seeing that they are fit to contain the season's crop. All these, whether intended for export or the local market, should be carefully cleansed and dried prior to giving them a coat of oil or lacquer. From experience gained at the grading-stores, it is apparent that beekeepers do not pay sufficient attention to packing. The tin is looked upon as a mere container, and is treated as such. Efficient methods of packing for export are required, and not the slipshod packing adopted in the past for auction-room sales.

SPRING WORK.

During August, whenever the temperature will allow, the colonies may be given their first examination. It is highly important that this work should not be postponed until brood-rearing has started in earnest, more especially in cases where ample stores were not left to carry the bees over the early stages of this important function. Delay in making an examination may lead to spring losses, and nothing is more tantalizing than to find colonies dead through neglect to provide sufficient stores. Usually a colony's requirements are attended to in the late autumn, when the apiarist endeavours to gauge the amount of food requisite to carry the bees through the winter and spring periods. It may happen, however, that mild weather will be experienced, when the

drain on the stores to feed the young bees, if not supplemented, will reduce a colony to starvation. Nothing should be left to chance during the critical months of spring, and no effort spared to see that each individual colony has sufficient food to meet current demands. Colonies which contain 15 lb. to 20 lb. of honey may be left until a later examination. If the hives contain less they should be watched closely and preparation made for feeding. See Bulletin No. 55, page 37, regarding the spring feeding of bees.

Queen-right colonies: Next to the item of stores the most important factor in a colony's condition is its queen. Advantage should be taken of the first examination to see that the queen is all right. If a colony is in normal condition as regards strength and stores there should be fair-sized patches of brood in the centre frames, but this is not sufficient to determine that the colony is queen-right. The cells adjacent to the brood should be quickly examined for eggs, which are the only indication that the queen is present. If neither brood nor eggs are found, then shelve the question of the colony being queenless till about ten days later. At each examination make a note of each hive and its condition for future reference. —*E. A. Earp, Senior Apiary Instructor.*

THE GARDEN.

VEGETABLE-CULTURE.

PEAS sown, and lettuce, cabbage, and broccoli planted out in late autumn, should now receive every attention to bring them along to early maturity. If not already done, plant out autumn-sown onions, shallots, and garlic, and sow peas, lettuce, radishes, and main-crop onions—for preference on areas devoted to root crops and celery last season. The parsnip main crop, early carrots, and white turnip, as well as the early potato crop, which should be sown and planted now, are best allotted to the heavily manured areas which have been carrying cabbage, broccoli, &c. Cabbage and cauliflower plants sown earlier should be planted out as soon as ready; for them the land cannot be too rich.

Rhubarb-beds will be coming into growth and should receive liberal treatment. A heavy dressing of stable manure and 3 cwt. of superphosphate per acre will suit the average beds. Follow this up with one or two applications, at intervals, of nitrate of soda, 2½ cwt. to the acre (1 oz. to the square yard). After a bed has been down for four years or so it should be taken up and a fresh plantation made. Old stools from such a bed may now be lifted, cut up, and planted out into a piece of well-prepared land. Work in a dressing of superphosphate before planting.

Asparagus-beds require a somewhat similar generous treatment. Where nothing has yet been done clean up the beds and apply a good dressing of partly decayed stable manure, following this up in August with 2 oz. each of superphosphate and sulphate of potash to the square yard. Applications of nitrate of soda and salt, of which this plant is fond, are best deferred for the present. If it is intended to plant out new beds prepare the land now for planting out in early September; seed, or plants two or three years old, may be used. As such beds have

to remain down for some years they should be made deep and rich, remembering that the plant likes abundant moisture during the growing season; it also requires perfect drainage.

Tomatoes.—Where a tomato crop is to be grown under glass the plants will now be well under way. Every advantage should be taken of fine warm weather to admit air and keep the plants firm and sturdy. Before planting them out towards the end of August lightly work in a dressing of chemical manures. Where the usual practice of growing and turning in a green crop has been observed, no nitrogenous manures will be required at this stage, the tomato-plant not being a gross feeder. A mistake under this heading usually leads to sterility and liability to many troubles, including black-stripe, which under such circumstances is difficult to control. A usual dressing at this stage consists of 7 oz. superphosphate and 4 oz. sulphate of potash to each 3 square yards. Where the preparation of the land has been delayed the soil is often loose and free, and plants set in such ground have their growth checked for a time. The tomato prefers a firm bed. Set the plants rather deep and firmly in the ground.

For outside culture tomato-seed may be sown now in boxes and raised in a frame on a hotbed. It is at such a time as this that a well-conditioned compost is of value. Such soil is of the right mechanical condition and contains suitable plant-foods. Of a correct moisture, sweet, and free from insect and fungus troubles, seedlings make uninterrupted progress in such a soil. On the other hand, soil taken direct from the garden and mixed with decaying vegetation and manures immediately before sowing is usually unsuitable; seedlings damp off and experience many infantile troubles that are annoying; results from such plants are very uneven.

The hotbed, too, is often hastily prepared, and as a result the temperature is uneven and of brief duration. Have the materials on hand in good time and place them in a compact heap to heat. After a few days, when this has taken place, the material must be shaken out and restacked, watering any portions that are dry. When it has heated up again repeat the operation, and in a few days it should be of an even consistency and ready for use. In building the bed, stack the materials evenly and tread them down firm. In a few days a steady heat will again have generated, when the frame can be put into position and the hotbed will be ready for use. Such a bed will maintain a steady heat for a long period and give good service.

Kumaras.—A place in such a frame is just the requisite position for starting kumaras. As stated in the Department's Bulletin No. 78, in the month of August tubers of the previous season's growth should be laid close together—but not touching—on a 1 in. layer of clean sand, and then covered to a depth of 4 in. with a sandy loam, or, more preferably, clean sand, and kept moderately moist. In four or five weeks' time the buds will have sprouted, and when the young shoots are 6 in. in length they are carefully removed and heeled closely in a well-sheltered and sunny position, and provision made so that they may be readily covered with scrim should there be any danger of frost. However, in the case of this crop a glass sashlight can be dispensed with if it is not available, and a good calico cover used instead.

Early and second-early potatoes should be got in as soon as the land is ready. A dressing of 3 cwt. superphosphate and 1½ cwt. sulphate of

potash per acre, hoed in just before planting, is of great assistance. Put the hoe through again as soon as the plants show above the ground.

SMALL-FRUITS.

Where it is intended to plant strawberries the work should now be taken in hand without delay. It is necessary that the land be clean and in good heart; the first condition is most important, and planting should not be proceeded with without it. In such a case sow a temporary crop and complete the cleaning of the land. As to the second condition, if there is any doubt, work in a good dressing of blood-and-bone manure. Spare no effort to get strong well-rooted plants of the right kind free from disease. Leaf-spot is one of the commonest troubles; at the first sign of it spray with bordeaux, 4–4–40 formula.

The growing of the edible passion-fruit is now receiving more attention. Seed sown during the autumn will now have developed into good strong plants, which will be ready for their permanent quarters in September. As with all permanent crops, the ground requires special preparation, for only superficial cultivation can be given later. To stand heavy cropping this plant requires generous treatment. This preparation should be completed during the coming month.

The Cape gooseberry is in considerable demand as a conserve, and those who have light well-drained sunny slopes would find it a profitable crop. Plants should be ready for planting out towards the end of October; sow the seeds now and place the boxes on a hotbed. Also commence the preparation of the land for the plants' reception, turning in any weeds or other vegetation growing there so that they may have time to rot before planting. Beds that cropped last season and are to be cropped again this year may be allowed to remain as they are for the present, until the danger of hard frosts is passed. The litter will protect the new shoots to some extent meanwhile.

Bush-fruits that have not yet had their winter bordeaux spray should receive it now. If the plants have started into growth weaken the mixture to, say, 4–4–40.

TOBACCO-CULTURE.

Tobacco—for smoking purposes—is now being grown extensively in some districts. It is very noticeable at the moment that the best leaf in the past season's crop was grown from plants that matured early—about the end of January. These plants were from seed sown early in August and planted out in October. The success of this crop depends so much on the critical period between germination and transplanting that too much care cannot be given to the preparation and management of the seed-beds.

Many of the troubles with weeds and fungus diseases would doubtless be overcome if the practice were in vogue that is general in the tobacco-growing sections of the United States and has been adopted by some of the more successful growers in Australia. It is that of burning the land to be used as a seed-bed, and is described as follows: "The land for the seed-bed should be cleared of rubbish and then burnt. As too much of the soil organic matter will possibly be burnt if the fire rests directly on the surface, poles of 3 in. or so in diameter should be placed across the plot to carry the fire, and on these fuel,

such as dry bushes, straw, &c., will be piled to a height of 4 ft. The fire should be started on the lee side of the heap to ensure a slow burn. The unburnt pieces of fuel should afterwards be raked off. 2 lb. superphosphate (or bonedust) and 1 lb. nitrate of soda (or sulphate of ammonia) should be applied to the bed (1 yard wide by 9 yards long, sufficiently big to grow plants for an acre), and the land then worked finely to a depth of 3 in. or 4 in." This operation should be carried out when the land is normally dry; land too wet for cultivation is too wet for burning.

Seed-beds on an easy slope facing the north, well sheltered, and sterilized in this manner should grow early plants if protected with a good calico or hessian cover. Used with discrimination, such a cover will prevent the bed drying after the seed is sown—an event that must not be allowed to happen—and also be a great protection against frost.

If not already commenced, preparation of the land for the tobacco crop should be got under way; it takes time as well as labour to get soil into a clean friable condition with all the vegetable matter well rotted down. In selecting areas for this crop it is to be remembered that it is not the heaviest land which is best. The lighter-coloured tobaccos that are in demand do best on a medium-quality porous soil.

For those unaccustomed to this crop it may be mentioned that it is usual to sow an even tablespoonful of seed to 50 square yards. To distribute it satisfactorily mix it with a pint of meal, sand, or ashes. After sowing, the seed should not be covered, but pressed into the ground firmly with a board or roller. Frame the seed-beds round with boards placed on edge to a height of 6 in., and cover with a hessian cloth.

HEDGES.

A green live hedge in good condition and suitably placed can be highly ornamental and of great utility. Difficulty is sometimes experienced in keeping such hedges in condition; investigation has shown many hedges to be thin and weak, and frequently heavily parasitized by insect blights. In most instances the primary cause is heavy cutting at unseasonable periods of the year. Should such drastic treatment be necessary, it is most important to perform the operation at the right season. For deciduous hedge-plants any time during the dormant period is suitable, while evergreens requiring heavy cutting should be dealt with in early spring. At that period hedges infected with insect parasites should be trimmed close in and the clippings burnt. The hedge should be afterwards immediately sprayed thoroughly with a good insecticide, repeating the application again in about a fortnight. Most hedges may, of course, be trimmed during the summer, but on such occasions it is usual to trim back the growth of the current season only.

LAWNS AND GREENS.

Most of our summer sports demand a smooth even turf for satisfactory performances. Such a high condition cannot be obtained satisfactorily by hasty work at the last moment. It is best to join forces with nature and give what assistance is necessary in the early spring. Weak lawns will require a top-dressing of a good compost, which should be prepared some time before it is applied, and should

consist chiefly of a clean fresh loam with a generous admixture of chemical fertilizers. Thoroughly rake over the green before applying it.

The benefit a green receives from the frequent application of a heavy roller is generally understood, but too often it is put off till the season's play is about to commence, when perhaps more harm than good is done by generous hosing and the almost endless use of the roller. Such attentions should be commenced now while the ground is really damp. On light soils especially the commencement can hardly be too early, as long as the frost is out of the ground. Ample rolling from time to time during the spring, with occasional applications of chemical fertilizers in solution, will result in a turf that will stand a lot of hard wear in the summer.

—*W. C. Hyde, Horticulturist.*

PRESERVATIVE TREATMENT FOR SOFTWOOD POSTS.

THE following reply has been supplied by the State Forest Service to a correspondent of the *Journal* who inquired regarding the preservative treatment of *Pinus insignis* for fencing-posts :—

Mr. Orton Bradley, of Christchurch, has forwarded to this office specimens of *Pinus* posts and pegs impregnated with coal-tar, which have given a life of over twenty years. These posts probably contained much more material than was actually required to preserve them, the wood being very absorbent. In applying any preservative treatments certain fundamental precautions must be observed. The timber should be thoroughly seasoned and all traces of both outer and inner bark removed. The adherence of a small piece of inner bark, perhaps only $\frac{1}{60}$ in. thick, may prevent any penetration of the preservative at this point, and decay will be almost sure to occur. If no cheap creosotes are available the crude tar may be used with advantage. It will be necessary to treat the whole of the post if *Pinus insignis* timber is used. In the interest of economy it will not be necessary to give as heavy a treatment to the top portion as to the butt of the posts. This could be effected by placing the posts upright in a tank of the preservative so that approximately the whole of that portion which goes in the ground, plus 6 in., may be in the solution. After sufficient tar has been absorbed by the posts they should be transferred to another tank where they may be placed lengthwise under the solution. They will not require to be left as long in this bath as in the first, as the tops will not require such a heavy absorption as the butts. The object of the treatment is to secure a deep enough penetration of the preservative, and in sufficient quantities to resist the attack of insects and fungi. Tars vary in composition to such an extent that no set times for treatment can be given. The penetration may be tested by drilling augur-holes in the treated timber. A satisfactory treatment will be attained when the whole of the sapwood has been penetrated by the tar. This is easily ascertained from the colour of the treated wood.

Imported Chaff and Weed-seeds.—At the last meeting of the Board of Agriculture a letter from the Director-General of Agriculture regarding the inspection of imported chaff was discussed. Members thought there was great need of further legislation to give power to the Department to order any such chaff which on examination was found to contain quantities of rubbish and seeds of weeds to be destroyed, if necessary, or to be subject to thorough cleaning so as to free it from deleterious seeds. The Board decided to ask the Minister to give further powers to Inspectors to deal with chaff, seeds, and plants found likely to bring weed-seeds and diseases to the Dominion.

New Rabbit District.—The constituting of the Maioro Rabbit District (Franklin County), for the purpose of Part III of the Rabbit Nuisance Act, was gazetted on 19th June.

WEATHER RECORDS: JUNE, 1924.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE first half of the year, completed with June, will be remembered in the North as a period of heavy rain. Rainfalls in June were also much above the average in the high levels of the South, but below normal in some of the east-coast districts of both Islands. Other parts of the country varied little from the average of the same month in previous years. There were several falls of snow on the ranges, but these quickly thawed, and the winter season so far has, on the whole, been rather mild, though frosts were frequent in the east-coast districts of the South Island. One of our observers in Southland ventures to remark: "The weather has been far too good for this time of the year—too mild. There are still too many blowflies about, and unless it becomes much rougher in July and August, spring and autumn are not likely to be good."

There were four distinct westerly disturbances during the month, which culminated on the 8th and 12th, and two which passed in the South on the 18th and 24th, while the weather between the 17th and 27th was very unsettled, with heavy showers in most parts of the country. An ex-tropical cyclone passed in the north and east-coast districts on the 14th and 15th, causing easterly gales and tremendous seas on the east coast, especially about Gisborne and Napier.

As is usual in winter months, storms alternated with periods of calm. On the whole, in winter the total velocity of the winds is usually less than in summer.

—*D. C. Bates, Director.*

RAINFALL FOR JUNE, 1924, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	8·56	19	1·20	5·53
Russell	7·35	16	3·25	6·28
Whangarei	7·16	17	1·71	5·26
Auckland	6·60	21	1·92	4·79
Hamilton	6·26	19	1·99	5·07
Kawhia	9·28	21	1·54	5·46
New Plymouth	5·14	24	0·77	6·21
Inglewood	9·95	23	1·50	10·31
Whangamomona	9·42	23	2·14	7·92
Tairua, Thames	6·94	11	3·10	6·95
Tauranga	4·65	19	1·41	5·05
Maraehako Station, Opotiki ..	8·26	14	4·14	5·68
Gisborne	4·44	15	1·06	5·21
Taupo	5·14	12	1·50	4·35
Napier	1·72	10	0·38	2·45
Maraekakaho Station, Hastings ..	1·69	16	0·36	3·33
Taihape	5·09	22	1·29	3·79
Masterton	4·02	20	0·79	3·41
Patea	3·75	19	0·63	4·40
Wanganui	3·71	12	0·59	3·29
Foxton	3·70	12	1·00	2·83
Wellington	2·96	21	0·56	4·87
South Island.				
Westport	6·31	19	1·10	7·53
Greymouth	6·40	15	0·98	8·99
Hokitika	9·54	15	1·36	9·72

RAINFALL FOR JUNE, 1924—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Arthur's Pass	22·28	11	4·37	9·77
Okuru, Westland	9·86	10	2·00	10·76
Collingwood	13·44	12	3·54	11·33
Nelson	3·34	9	1·40	3·75
Spring Creek, Blenheim	2·66	6	1·50	3·23
Tophouse	9·01	11	1·89	4·99
Hanmer Springs	4·90	13	1·37	2·83
Highfield, Waiau	1·78	8	0·40	2·50
Gore Bay	2·17	9	0·45	2·30
Christchurch	1·98	12	0·51	2·64
Timaru	0·55	6	0·23	1·84
Lambrook Station, Fairlie ..	..	..	..	2·06
Benmore Station, Omarama ..	2·05	6	0·85	2·06
Oamaru	0·99	5	0·40	2·11
Queenstown	4·56	11	1·16	2·41
Clyde	1·02	8	0·37	0·98
Dunedin	..	..	..	3·13
Gore	2·79	15	0·47	2·76
Invercargill	4·16	19	0·64	3·54

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 15th May to 10th July, 1924, include the following of agricultural interest:—

No. 50486: Animal-trap; W. H. Thomas, Southland. No. 51622: Garden-propagating-frame heating; C. Hancock, Letchworth, England. No. 51798: Cheese-making rack; H. H. Gilshnan, Te Kiri. Nos. 48932 and 50385: Milk-pipe union; F. Allen, Dannevirke. Nos. 48965 and 48996: Milking-machine milk-measuring means; O. H. Burt, Featherston. No. 49923: Cow-milker apparatus; J. B. MacEwan and Co., Ltd., Wellington. No. 49982: Milking-machine pulsator; C. F. Lumley and M. Lumley, Featherston. No. 50024: Milk-can-cleaning means; R. F. Searle, Matamata. No. 50155: Garden tool; R. A. Martin, Taradale. No. 50356: Milking-machine releaser; C. A. Martin, Hamilton. No. 51072: Cheese-mould; G. Gray, Stratford. No. 51692: Meat, fruit, and fish preserving; X. Simon, Buenos Aires. No. 51744: Teat-cup brush; W. Cavanagh, Te Awamutu. No. 51810: Tilling-tool, yoking to tractor; R. Mozer, Geneva, Switzerland. No. 50083: Milking-machine claw and pulsator; R. C. and R. G. Green, Peria. No. 50150: Milk and cream aerating and cooling; C. E. Hardley, Auckland. No. 50179: Milking-machine; A. Sabroe, Denmark. Nos. 50298 and 50443: Milking-machine releaser; K. G. Watson and D. McMahon, Te Aroha. No. 50407: Pasteurizer milk- or cream-flow control; L. Hansen, Christchurch. No. 50562: Bale-fastener; S. H. Hughes, Victoria. No. 51186: Cheese-mould; R. Wyeth, Orawia. No. 50195: Milking-machine pulsator; R. B. Forsyth, Christchurch. No. 51932: Fruit-grader; R. Burgess, Spring Creek. No. 50386: Wool-deburring machine; C. C. Masey, Victoria. No. 51879: Incubator and foster-mother; C. Hancock, England. No. 49398: Sprayer; B. F. Mitchell, Auckland. No. 50050: Fencing-wire attachment to concrete post: H. W. Snelling, Auckland. No. 50497: Milking-machine teat-cup inflation; R. N. Pilkington, Hamilton. No. 50741: Hay-sweep; C. Hansen, Waihi. No. 51153: Weeding-device; C. H. Pugh, Ltd., and G. F. Bute, England. No. 51948: Fertilizer; J. C. Hutton Proprietary, Victoria.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price, 1s.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PRECAUTIONS REGARDING CONTAGIOUS MAMMITIS.

"INTERESTED," Tauranga :—

I have a cow that developed contagious mammitis shortly after calving about eight months ago. She was turned out then, and has been running with a calf ever since. The calf has been sucking all her teats, and there is no sign of a hard quarter now. I would like to know if the trouble would be likely to recur upon calving this year, and, if not, whether the cow would still be a source of infection to the others.

The Live-stock Division :—

If the cow suffered from contagious mammitis eight months ago the organism of the disease may still be present in the milk, although the udder may appear normal. In order to ascertain if the organism is still present, the milk should be microscopically examined. If you will forward a sample of the milk to the Officer in Charge, Veterinary Laboratory, Wallaceville, Wellington, he will, after examination of the milk, be able to advise you on this point. Before taking a sample the calf should be kept from the cow. During the night the teat of the affected quarter should be thoroughly cleansed, and the first portion of the milk caught in a sterilized bottle and forwarded for examination.

RIDDING PLUM-TREES OF MOSS.

"NOVICE," Awhitu :—

Please inform me as to the best method of getting rid of moss from some Burbank plum-trees which have been neglected for some time. The trunk and branches are fairly thickly covered with this growth.

The Horticulture Division :—

To rid the plum-trees of an accumulation of moss remove the worst of it from the trunk and main limbs with a scraper. Later—just before spring growth commences—apply thoroughly a spray of bordeaux mixture, winter strength. Follow with another application, summer formula, just as the flower-buds show white. Details for making these mixtures will be found in the Department's Bulletin No. 82.

BLINDNESS IN DOGS.

N. TYERMAN, Owhango :—

I have two dogs both partly blind, and I wish to know if anything could be done to restore their sight. The dogs are full brothers, and about three years old. One has been partly blind for about twelve months, and lately the other has shown exactly the same symptoms. The trouble seems to be caused by the expanding of the pupils of the eyes to about the full size of the eye. The dogs appear able to see better at a distance than close at hand. Both are in good health and have always been so.

The Live-stock Division :—

Without an examination of the animals it is somewhat difficult to advise you. We are of the opinion, however, from the symptoms given, that the animals are suffering from cataract. This is a condition in which the lens of the eye loses its transparency. In the earlier stages of the disease the animal, although able to see, is unable to measure distance: the complaint invariably ends by causing total blindness. Further than keeping the animal in good health, little can be done in this disease by way of treatment.

REMOVING CATTLE FROM TICK-INFESTED COUNTRY.

"NORTH AUCKLAND," Waipu :—

I have put my cows to graze on tick-infested property, and wish to know when I should remove them to avoid the possibility of their coming back laden with ticks. They were put out on 28th May, and are due to calve about the middle of August. Please advise me of the latest date for safety.

The Live-stock Division :—

There is no period of the year when stock can be removed with safety from tick-infested country. Although mature ticks are not seen on stock during the winter months, there is always the danger that the animals are harbouring seed-ticks, and these, while difficult to detect, can easily infest clean areas if carried there by stock. In order to ensure that these parasites are not brought to your farm, the cows should be thoroughly sprayed with a solution of cattle-dip before they leave the affected area.

WORMS IN PIGS.

"INQUIRER," Ashburton :—

Could you please tell me the cause of and cure for worms in pigs?

The Live-stock Division :—

The inquiry covers a very wide field, as pigs may become affected with a variety of parasites classed as worms, the cause and treatment varying with the variety affecting the animal. It is probable that the particular worm regarding which you desire information is a large white one called *Ascaris lumbricoides*. It is more or less frequently found in the intestines of pigs, and if in large numbers causes digestive troubles, unthriftiness, &c. Pigs become affected by ingestion of food or water affected with the eggs or ova of the adult worms. These eggs or ova can be found in the droppings or fæces of pigs affected with the worms. Insanitary conditions and overcrowding help to spread the trouble. The following treatment is recommended: Give the pigs no food for twenty-four hours, then give 1 dram (a level teaspoonful) of freshly powdered areca nut thoroughly mixed with 1½ pints of milk for each half-grown pig (it is usually young pigs which are affected). Four hours afterwards give the following purgative: Epsom salts, 2 oz., dissolved in warm water, and mixed with 2 quarts of milk for each pig. Care should be taken to see that each animal gets its proper dose. It is advisable to repeat this treatment twice at intervals of eight days. The discharges from the pigs should be cleaned up and burnt immediately after the animal ceases to purge, otherwise the eggs will reinfect the pigs. Another method of treatment is to give 8 grains of santonin mixed in the feed on two consecutive mornings, and on the third morning give 8 grains of calomel mixed in the feed.

NEW-MILK SUBSTITUTES FOR CALVES.

"COW-SPANKER," Wanganui :—

Could you please inform me what is the best, cheapest, and easiest substitute for new milk to give to young calves, along with skim-milk?

The Live-stock Division :—

There are many recipes for substitutes for new milk in calf-rearing. A good one is six parts of oatmeal to one of ground linseed. An amount of 2 lb. of this mixture per calf is scalded overnight with 5 pints of boiling water. In the morning this should be boiled for ten minutes, adding 5 or 6 pints of separated milk, with a little salt and sugar. This is divided into two or three parts to be fed during the day. The following are also suitable recipes: (1.) 3 quarts linseed-meal, 4 quarts bean-meal, 30 quarts boiling water. Cover for twenty-four hours and give equal proportions of mixture and warm skim-milk. (2.) Finely ground linseed-cake, 7 lb.; mixed meal, 7 lb.; hot water, 7 gallons. Give as above.

Importation of Horses from Fiji.—Regulations relating to this matter were gazetted on 26th June. They are to be read with and form part of the regulations under the Stock Act gazetted on 7th October, 1915.

PLANTATIONS ALONG BOUNDARY-FENCES.

THE following inquiry was received recently from a station-owner: "Last year I put in a plantation along a boundary-fence. The nearest trees are 6 ft. from the fence, but my neighbour objected to this plantation, in writing, three months after it had been put in. I did not ask his permission to plant. He now expects me to root out the entire plantation. Is he legally entitled to force me to do this? I should be much obliged for information." The point being an important one of wide interest, the reply made by the Department is published hereunder:—

The position is governed by section 26 of the Fencing Act, 1908, which reads as follows:—

> "No person shall, whether for the purpose of making a live fence or otherwise, plant or sow gorse or trees—(*a*) On or alongside any boundary line or fence without the previous written consent of the occupier of the adjoining land; or (*b*) on or alongside any boundary line or fence bounding or abutting on any Crown lands, public reserve, or railway without the previous written consent of the proper authority having the management or control thereof.
>
> "(2.) No person shall under any circumstances or for any purpose plant or sow sweetbrier, bramble, or blackberry on or alongside any such boundary line or fence as aforesaid.
>
> "(3.) Every person who commits a breach of any of the provisions of this section is liable for every such offence to a fine not exceeding twenty pounds.
>
> "(4.) Irrespective of any such fine, the occupier or proper authority as aforesaid may enter on the land and cut down, uproot, and destroy all gorse or trees, sweetbrier, bramble, or blackberry planted or sown in breach of this section, and may recover the cost of so doing from the person who planted or sowed the same."

The question as to what constitutes "alongside any boundary-line" has not, so far as we are aware, been determined, but it was held by the Court of Appeal in the case Spargo *v.* Levesque (New Zealand Law Reports, 1922) that the right of an occupier to enter adjoining lands and to cut down and destroy trees planted thereon in breach of section 26 of the Fencing Act, 1908, could only be lawfully exercised after proceedings had been taken against the person planting the trees for a breach of the section and a conviction obtained.

Section 37 of the Fencing Act provides that all proceedings before a Magistrate in respect of any of the matters in regard to which he has jurisdiction (see section 36) shall be by summons in the prescribed form, and such proceedings shall be conducted and all orders thereon by the Magistrate may be made, enforced, and acted upon in like manner as in the case of summary proceedings under the Justices of the Peace Act, 1908. Sections 48 and 49 of the latter Act deal with the procedure preliminary to the hearing of a case, and these are quoted for your information:—

> "48. Where a person is charged before a Justice with the commission of an offence for which he is liable to be punished on summary conviction before Justices, the information shall be taken in writing, and shall be in the form (No. 4) or to the effect thereof; but it need not be substantiated on oath, unless it is intended to issue a warrant to compel the appearance of the person charged.
>
> "49. Every such information shall be laid within six months from the time when the matter of such information arose, except in cases where some other period of limitation is provided by the Act constituting the offence or any other Act."

If the position is that no information was laid by your neighbour within six months, then it would seem that he has forfeited his legal right to objection, but this is a point of law upon which the Department is not able to definitely advise you.

Rabbit-control.—Regulations relating to the destruction of rabbits in the Kiwitea Rabbit District were gazetted on 19th June. They empower the Board to prevent trapping in the district.

REGISTRATIONS OF FACTORIES, ETC., UNDER THE DAIRY INDUSTRY ACT: 30th April, 1924.

District.	Creameries (Butter).	Factories (Cheese).	Dual Plant (Butter and Cheese).	Private Dairies.		Packing-houses (Milled Butter).	Totals.
				Butter.	Cheese.		
Auckland	64	46	6	..	..	1	117
Taranaki	18	79	34	..	..	..	131
Wellington	16	54	11	..	..	1	82
Hawke's Bay ..	11	16	3	..	..	..	30
Nelson	6	4	1	..	..	3	14
Marlborough ..	4	4	3	..	..	..	11
Westland	8	2	..	..	..	..	11
Canterbury	12	14	3	..	6	..	35
Otago and Southland	17	75	2	..	..	..	94
Totals ..	156	294	64	..	6	5	525

Seven milk-powder factories (four whole-milk and three skim-milk plants), one condensed-milk factory, one sugar-of-milk factory, and three casein-factories are also established in the Dominion.

REGISTRATION UNDER THE FERTILIZERS ACT.

THE Fertilizers Act, 1908, requires every vendor of fertilizers to register his name and address before offering any fertilizer for sale, and thereafter on or before 1st July in each year. The Act defines a vendor as any person who, either on his own account or on behalf of any other person, sells in the ordinary course of his business any fertilizer. Storekeepers and others who act as agents for manufacturers and mixers of fertilizers are therefore "vendors." Vendors who carry on business at more than one address are required to register each address. It is sufficient if the addresses of all the branch establishments are stated on the head office registration forms.

It should be noted that, where a vendor has already registered a fertilizer during the current year, it is not necessary again to register the same particulars on 1st July. Many vendors are evidently under the impression that the registration year commences on 1st July, and that all fertilizers must then be registered afresh. This is not so. A second registration during any year (January to December) is necessary only where the previously registered particulars of a fertilizer require amendment.

On each sale of 5 cwt. or more the vendor must supply the purchaser with an invoice certificate showing the true particulars of the fertilizer as registered. All packages must be clearly and distinctly branded with the registered brand; provided that where any mixture is made up according to the written instructions of the purchaser it is sufficient to brand the packages "Special mixture."

British Market for Peas and Beans.—The following information was cabled by the High Commissioner, London, on 5th July: *Peas* (Blue)—Demand is limited. Japanese shipments about to arrive quoted at £19 15s. to £20 10s. c.i.f.; spot, £20 to £21 per ton. In new crop September-October shipments business is being done at £20 c.i.f. Dutch small round hand-picked, £20. Tasmanian "A" grade, £18 c.i.f.; spot value about £20 10s. for best quality only. New Zealand good quality worth £17 to £18. (Maple)—English in small supply. "A" grade Tasmanian on passage worth 72s. to 76s. per quarter. New Zealand Partridge No. 1 for shipment, 62s. 6d. to 65s. c.i.f. *Beans*—English selling at 47s. to 50s. per quarter; no inquiries for imported.

LIST OF QUALIFIED VETERINARY SURGEONS.

THE following list of qualified veterinary surgeons known to be residing in New Zealand is published for the guidance of stockowners and for general information. In the event of the name of any properly qualified veterinarian being omitted it is requested that he communicate with the Director of Live-stock Division, Department of Agriculture, Wellington, giving particulars of his qualification, in order that the necessary steps may be taken for the inclusion of his name in the next published list.

Aberdeen, C., L.V.Sc. (Melb.), Wanganui.
*Ashe, G. G., M.R.C.V.S., Belfast.
*Barnes, A. W., M.R.C.V.S., Hastings.
*Barry, W. C., M.R.C.V.S., Auckland.
Bayley, A., M.R.C.V.S., Hawera.
Begg, W. F., M.R.C.V.S., Te Awamutu.
*Blair, W. D., M.R.C.V.S., Invercargill.
*Blake, T. A., M.R.C.V.S., Masterton.
Brodie, A. M., M.R.C.V.S., Hastings.
*Broom, G., M.R.C.V.S., Gisborne.
Burton, S., M.R.C.V.S., Hamilton.
Carbury, H. W., M.R.C.V.S., Otorohanga.
Cockroft, J. E., M.R.C.V.S., Feilding.
*Collins, W. T., M.R.C.V.S., Wellington.
Crossley, F., M.R.C.V.S., Palmerston North.
Cunningham, T., M.R.C.V.S., Oamaru.
*Danskin, J., M.R.C.V.S., Dunedin.
*Dayus, C. V., M.R.C.V.S., Auckland.
*Elphick, E. E., M.R.C.V.S., D.V.H., Wellington.
Fletcher, S., B.V.Sc. (Melb.), Whakatane.
*Gill, D. A., M.R.C.V.S., Palmerston North.
Glover, F., M.R.C.V.S., Hamilton.
Gregory, J. S., B.V.Sc. (Melb.), Leeston.
*Hickman, A. J., M.R.C.V.S., Auckland.
Hankin, T. H., M.R.C.V.S., Pukekohe.
*Haugh, P., M.R.C.V.S., Petone.
*Hopkirk, C.S.M., B.V.Sc. (Melb.), Wallaceville.
*Howard, E. C., M.R.C.V.S., Wanganui.
Johnson, A. A., F.R.C.V.S., Christchurch.
*Kerrigan, J., M.R.C.V.S., Christchurch.
Kyle, H. S. S., G.M.V.C. (Melb.), Templeton.
*Lawson, J. N., B.V.Sc. (Sydney), Wanganui.
*Le Souef, H. D., B.V.Sc. (Melb.), Wellington.
*Lukey, E. J., B.V.Sc. (Melb.), Christchurch
*Lyons, J., M.R.C.V.S., Auckland.
*Mackenzie, A., D.V.S.M., M.R.C.V.S., Hamilton.
*Marsack, H. L., V.S. (Ontario), Auckland.
Marshall, D., M.R.C.V.S., Balclutha.
Martin, H. E., M.R.C.V.S., Christchurch.
*McGregor, P., M.R.C.V.S., Christchurch.
*Meade, R. H., M.R.C.V.S., Palmerston North.
Miller, J., M.R.C.V.S., Invercargill.
*Paterson, A. M., M.R.C.V.S., Timaru.
Quinnell, W. C., M.R.C.V.S., Wellington.
*Reakes, C. J., M.R.C.V.S., D.V.Sc., Wellington.
*Reid, H. A., F.R.C.V.S., D.V.H., F.R.S.E., Wellington.
Ring, W. C., V.M.D. (Penn., U.S.A.), Ellerslie.
Siddall, E. L., M.R.C.V.S., Opotiki.
Simpson, C. S., M.R.C.V.S., Auckland.
*Snowball, W. D., M.R.C.V.S., Dunedin.
*Stafford, J., M.R.C.V.S., Christchurch.
†Stapley, W., M.D., D.V.Sc., M.R.C.V.S., Cambridge.
Taylor, A., F.R.C.V.S., Christchurch.
Taylor, H. C., M.R.C.V.S., Dannevirke.
Taylor, J. B., M.R.C.V.S., Waverley.
Taylor, W. G., M.R.C.V.S., Wellington.
Thompson, A. L., M.R.G.V.S., Stratford.
*Wood, R. B., M.R.C.V.S., Waitara.
*Young, A. R., M.R.C.V.S., Wellington.

* Officers of the Department of Agriculture. † Not practising as a veterinary surgeon.

STOCK SLAUGHTERED, 1923–24.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1924 :—

Stock.	Abattoirs.	Meat-export Works.	Bacon-factories.	Ordinary Slaughterhouses.	Totals
Cattle ..	143,961	184,848	..	82,225	411,034
Calves ..	35,375	18,776	..	2,372	56,523
Sheep ..	570,350	1,932,259	..	271,434	2,774,043
Lambs ..	84,546	5,118,981	..	23,323	5,226,850
Swine ..	99,635	113,200	30,083	23,466	266,384

Winter Farm-schools.—In addition to the fixtures announced in the *Journal* for April last, courses have been arranged for Westland, at Greymouth, from 22nd to 25th July; and for Marlborough, at Blenheim, from 4th to 8th August.